

Service Manual

Panasonic U-vision

Vol. 1

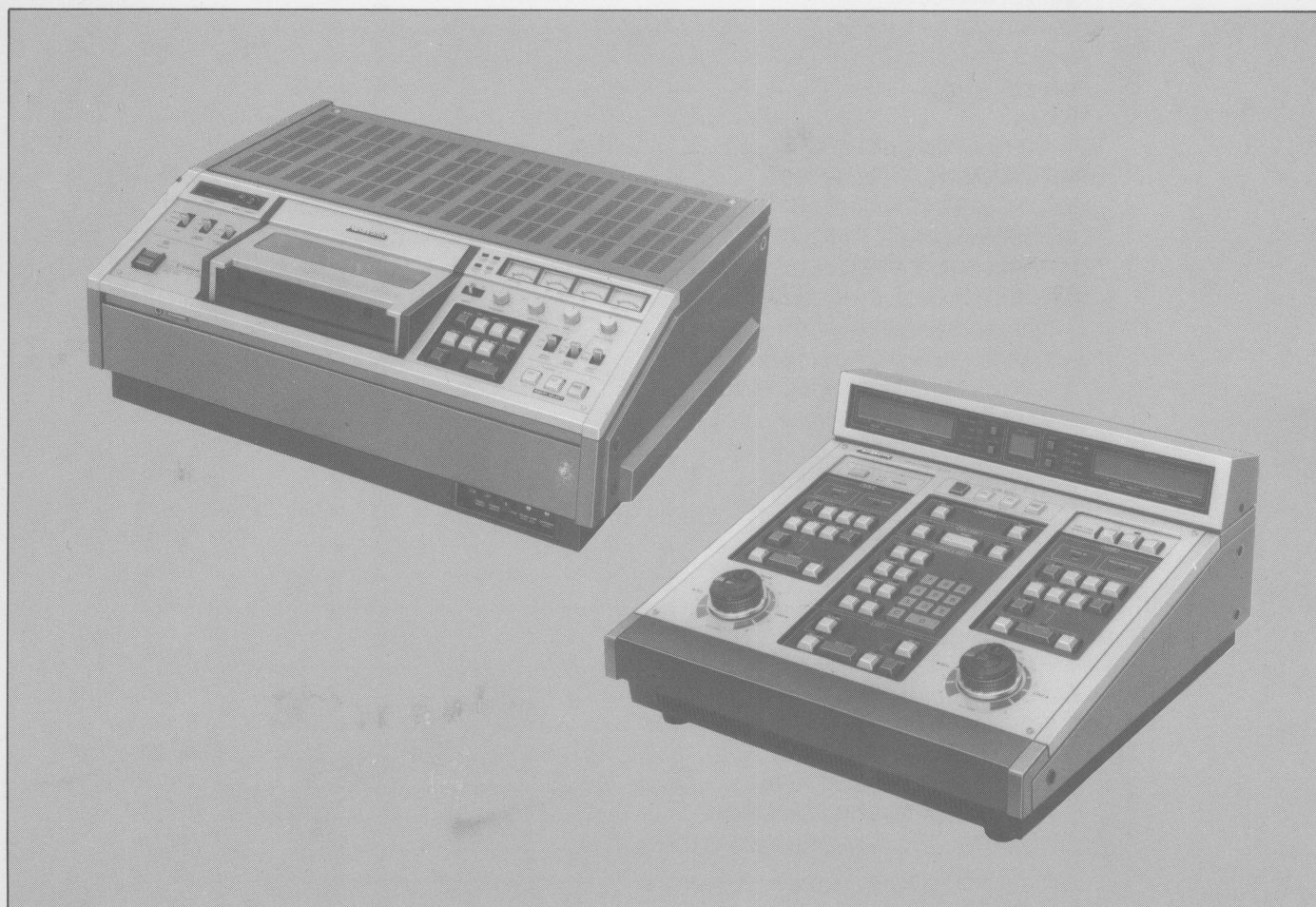
Broadcast Editing Video Cassette Recorder

AU-700

Programmable Editing Controller

AU-A70

*Operating Instructions
Mechanical Description
Circuit Description*



Panasonic®

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FEATURES

1. High quality editing with flying (rotary) erase head, vertical interval edit switching.
2. Direct drive video head cylinder (DDC) motor for high stability and less jitter.
3. Capstan servo system maintains precise head-to-tape speed, and allows vertical locking to an external signal.
4. Perfect frame by frame alignment at edit points with framing capstan servo system with EIA RS-170A type sync. (No half line error or missing signals for full interlace and proper field **synchronization**.)
5. Field-by-field editing with EIA RS-330 type signal.
6. Performs insert and assemble editing of video and two audio channels (all independently selectable).
7. **Mates with optional editing controller AU-A70 or editing controller NV-A960.** (This unit can also be used with editing controller NV-A950.)
 - (a) Performs insert and assemble edits automatically.
 - (b) Provides normal playback/reverse speed, fast playback/rewind (2x and 5x normal playback speed), slow playback/rewind and ultraslow playback (1/5x and 1/20x normal playback speed) as well as pause to help in finding the edit point with the search dial (used with AU-A70 and NV-A960).
 - (c) Preroll function back spaces the recorder.
 - (d) Preview mode (rehearsal) without actually performing the edit, as well as review mode after editing.
 - (e) Memory for entry and exit points of insert or assemble.
 - (f) Edit mode reference from either source or editor.
 - (g) Programmable editing with auto editing controller AU-A70.
 - (h) Allows the use of two source VCRs by using the AU-A70 and the Multiple Source Adaptor AU-J10.
8. Time-code track selector for selection of AUDIO CH1 or ADDRESS (Time Code).
9. External composite sync input provides vertical stability in dubbing system configuration and for TBC connection.
10. Subcarrier input for use with a time base corrector.
11. Convenient RF output is provided with DOC (dropout compensator) cut-off switch for connection to a time base corrector with DOC.
12. Chroma level adjustment.
13. Automatic elevator and gear driven loading systems permits simple, smooth and reliable tape loading and faultless operation.
14. Feather-touch (non-locking) push buttons with logic memory allows direct switching from one function to another, for example FF to PLAY or REW to PLAY, without first pressing the stop button.
15. 7-pin dubbing connector for dubbing.
16. With built-in dew detecting device.
17. Compensation of horizontal sync phase is possible for optimization of edit lock.
18. Increased reliability due to increased use of LED display devices.
19. Optional remote control unit, NV-A152, controls record, forward, fast forward, rewind, stop, and pause (still frame).
20. Counter display reading out CTL pulse for tape counter.
21. Automatic search during rewind or fast forward by setting memory counter to "0000".
22. Automatic or manual control of video level, with video level meter.
23. Two audio tracks permit recording from two MICROPHONES, pre-amplified STEREO PHONOGRAPH, etc.
24. Two audio level meters, one for each channel.
25. Audio limiter (switchable) for low distortion recording.
26. Audio monitor output, for one or both audio channels.
27. Balanced connector for audio input/output.
28. Audio input level/impedance selector switch for the audio input signal.
29. Two connectors simultaneously applicable to 2 different methods of video input/output signal connection.
30. Loop-through video input with a 75 ohm termination switch.
31. Audio level selector for headphone.
32. Automatic phase control (APC) for stability of the color signal.
33. Comb filter and HPF™ video heads for high quality picture.
34. Dropout/noise compensator.
35. Automatic rewind at the end of the tape. The tape stops and fully rewinds automatically.

Editing Video Cassette Recorder Panasonic U-vision **AU-700**

SPECIFICATIONS

Power Source: AC 100/120/220/240 V (Selectable), 60/50 Hz
Power Consumption: Approx. 140 watts
Television System: EIA Standard (525 lines, 60 fields) NTSC color signal

Video Recording

System: 2 rotary heads, helical scanning system
Luminance: frequency modulation recording
Color signal: converted subcarrier, direct recording

Audio Track: 2 tracks
Tape Format: Tape width 3/4 inch (19mm), high density tape
Tape Speed: 3-3/4 i.p.s. (95.3mm/s)
Vow Flutter: Less than 0.1% rms
Record/Playback Time: 60 min. with NV-P26
FF/REW Time: Less than 5.0 min. with NV-P26
Heads: Video: 2 rotary heads
 Audio/Control: 1 stationary head
 Control (P.B. only)/Time code (Rec/P.B.): 1 stationary head

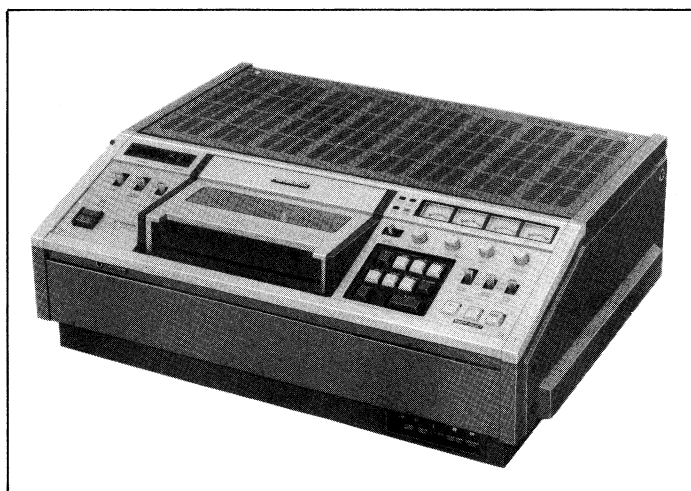
Erase: 1 full track erase
 2 selectable audio erase tracks for editing
 2 flying (rotary) erase heads

Input Level: Video: TV Monitor connector (8 P) 1.0Vp-p, 75Ω unbalanced
 VIDEO IN connector (BNC) × 2 1.0Vp-p, 75Ω unbalanced
 Dub In Connector (7 P): chroma level 0.9Vp-p, luminance level 1.0Vp-p
 Audio: TV Monitor connector (8 P) -20dB, 100kΩ unbalanced
 MIC (XLR) × 2 -60dB, 600Ω balanced
 LINE IN (XLR) × 2 +4dB, 600Ω/high impedance balanced

Sub carrier: (BNC) 2.0Vp-p, 75Ω unbalanced
Composite sync: (BNC) 4.0Vp-p, negative pulse, 75Ω unbalanced

Time code: (RCA) 1.0Vp-p, 10kΩ unbalanced
 Video: TV Monitor connector (8 P) 1.0Vp-p, 75Ω unbalanced
 VIDEO OUT connector (BNC) × 2 1.0Vp-p, 75Ω unbalanced
 Dub Out Connector (7 P): chroma level 0.9Vp-p, luminance level 1.0Vp-p

Output Level: Audio: TV Monitor connector (8 P) 0dB, 5kΩ unbalanced
 LINE OUT (XLR) × 2 +4dB (+4dB/-6dB switchable), 600Ω balanced



AUDIO MONITOR OUT jack (RCA) 0dB, 5kΩ unbalanced

HEADPHONE jack:

High -26dB, 8Ω

Low -32dB, 8Ω

RF out: (BNC) 0.5Vp-p, 75Ω unbalanced

Time code: (RCA)

2.4Vp-p, low impedance unbalanced unbalanced

Video Horizontal

Resolution: Color: better than 260 lines (on monoscope test pattern)

B/W: better than 330 lines

Video Frequency

Response: 3 MHz (0dB)

3.8MHz (±3dB)

Audio Frequency

Response: 50 ~ 15,000 Hz

Signal-to-Noise Ratio: Video: better than 46dB (Color) better than 50dB (B/W)

(Rohde & Schwarz noise meter)

Audio: better than 48dB (3% distortion level)

Audio Distortion: Less than 3%

Audio Cross Talk: Better than 40dB

Wow & Flutter: 0.12 rms

Operating

Temperature: 41°F ~ 104°F (5°C ~ 40°C)

Operating Humidity: 35% ~ 80%

Weight: 79.2 lbs. (36kg)

Dimensions: 26-1/8"(W) × 9-3/8"(H) × 18-3/4"(D)
 661(W) × 238(H) × 475(D)mm

Accessories Supplied: 1 pc. AC power cord, VJA0129

1 pc. Dubbing cable, VJA0151

1 pc. Dust cover, VFB0006

Optional Accessories: 3/4" video cassette tape:

NV-P23 Approx. 610ft. (186m), 30 min.

NV-P26 Approx. 1,175ft. (358m), 60 min.

Head cleaning tape, NV-P20

Remote control unit, NV-A152

Editing controller, AU-A70

Multiple source adaptor, AU-J10

Editing controller, NV-A960

Auto Search Controller, NV-A800

Specifications are subject to change without notice.

Weight and dimensions shown are approximate.

PRECAUTIONS

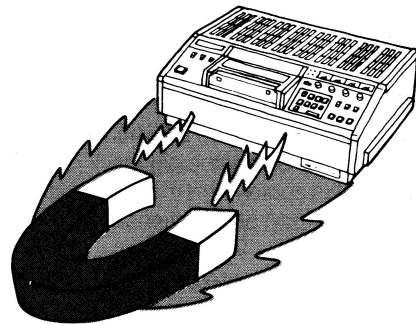
Do not insert fingers or any other object into the video cassette compartment.



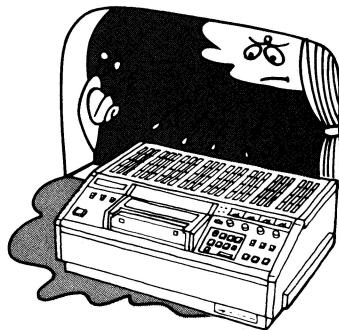
If this unit is suddenly moved from a cold to a warm place, condensation may form inside. Therefore wait for at least 60 minutes before operating again while turning on the machine.



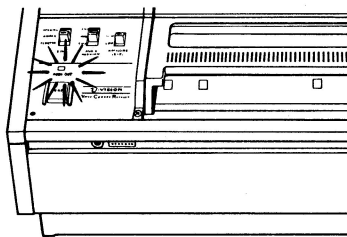
Avoid operating or leaving the unit near strong magnetic fields. Be especially careful of large audio speakers.



Avoid operating or storing the unit in an excessively hot, cold, or damp environment as this may result in damage both to the recorder and to the tape.



If, as described above, excessive moisture or condensation does form inside the recorder, the Auto OFF light will glow if the power is ON. While the Auto OFF light is on, the unit will not function. Let the unit remain at a room temperature with power ON until the Auto OFF light is no longer illuminated.



- Do not block the ventilation slots on the top and bottom of the unit.
- Use this unit horizontally and do not place anything on the top panel.
- Cassette tape can be used only for one-side, one direction recording. Two-way or two-track recordings cannot be made.
- Cassette tape can be used for either Color or Black & White recording.
- This unit is supplied with a 3-prong grounded AC plug—do not try to defeat its purpose.
- Do not spray any cleaner or wax directly on the unit.
- If the unit is not going to be used for a length of time, protect it from dirt and dust by using the dust cover.

- Do not leave a cassette in the recorder when not in use.
- Do not attempt to disassemble the recorder. There are no user serviceable parts inside.
- If any liquid spills inside the recorder, have the recorder examined for possible damage.
- Refer any needed servicing to qualified service personnel.

“Unauthorized recording of copyrighted television programs, films, video tapes and other materials may infringe the right of copyright owners and be contrary to copyright laws.”

- Note:**
- Please read the attached warranty card completely.

FOR YOUR SAFETY

WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE.

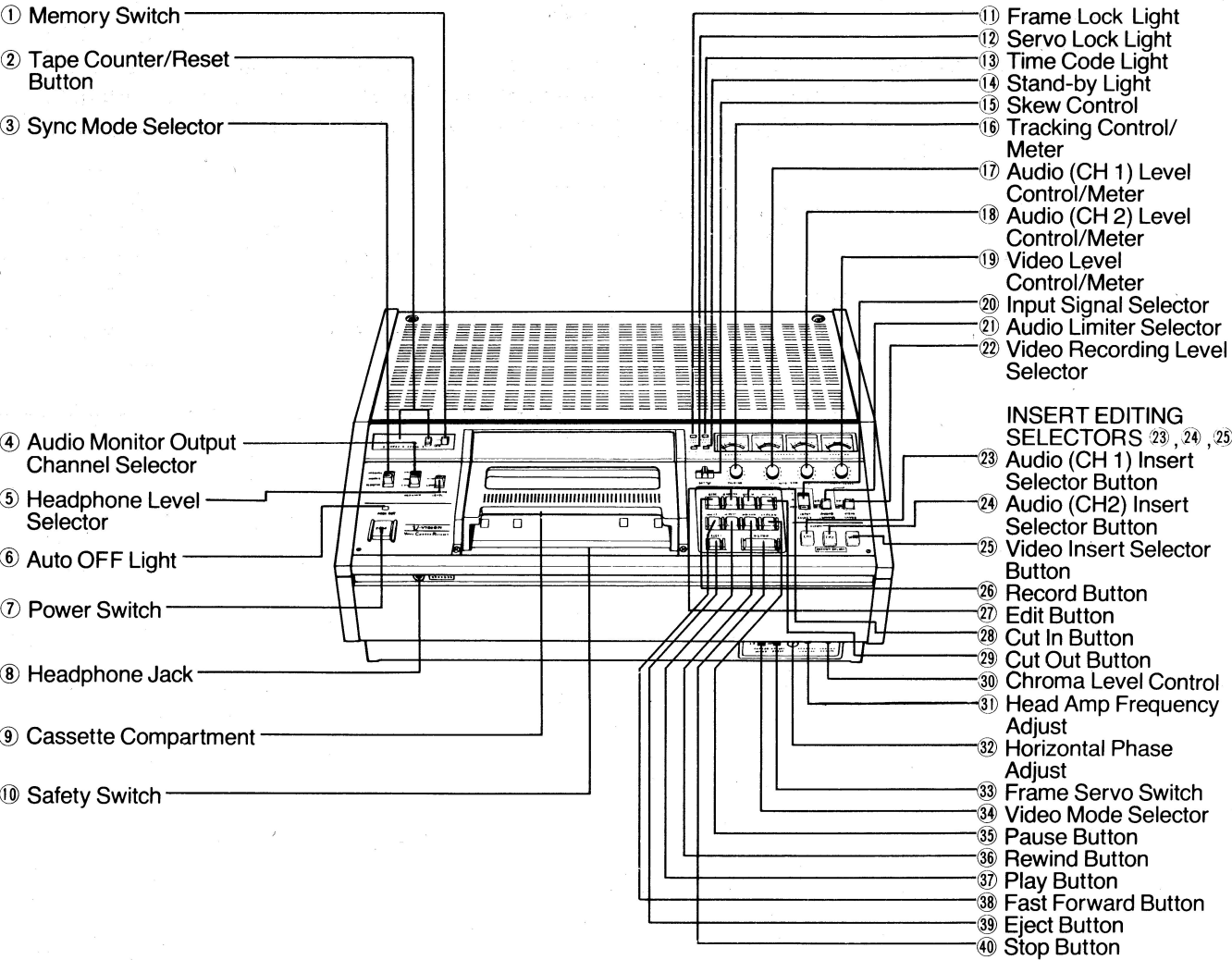
VOLTAGE ADJUSTMENT

To adjust the voltage selector, turn the voltage selector with a screwdriver.

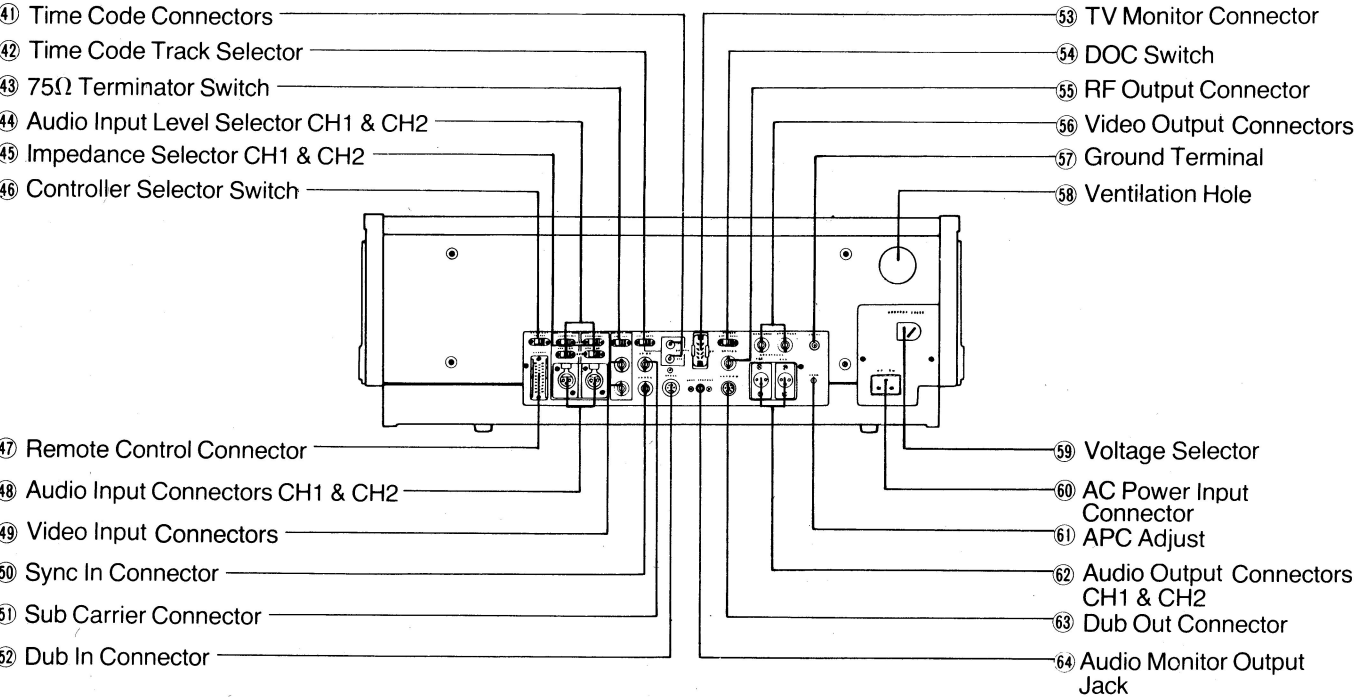
CAUTION: Operation at a voltage setting higher than 125VAC may require the use of a different AC plug or cord set. Please contact either a local or foreign Panasonic authorized service center for assistance in selecting an alternate AC plug or cord set.

	SETTING THE VOLTAGE SELECTOR				
	LOCAL VOLTAGE	AC 100 V	AC 120 V	AC 220 V	AC 240 V

MAJOR OPERATING COMPONENTS
TOP and FRONT



REAR



CONTROLS AND THEIR FUNCTIONS

TOP and FRONT

- ① **Memory Switch [MEMORY]**
When this switch is in the "ON" position, the tape will automatically stop during rewind or fast forward when the Tape Counter display indicates nearly "0000". By starting the recording from this "0000" point, subsequent playback location will be more convenient.
- ② **Tape Counter/Reset Button [COUNTER]**
When the Reset Button is pressed, the Tape Counter display will reset to "0000". When tape is rewound beyond the "0000" position, the display will turn up "—".
- ③ **Sync Mode Selector [SYNC]**
This selector determines the input to synchronize the VCR servo from three types of signals: external, internal or normal (incoming video). (See page 11 for details.)
- ④ **Audio Monitor Output Channel Selector [AUDIO MONITOR]**
Selects the audio channel desired to be heard on the TV monitor, headphone, or through Audio Monitor Output Jack.
CH1: To monitor audio CH1 only.
MIX: To monitor mixed audio of both CH1 and CH2.
CH2: To monitor audio CH2 only.
- ⑤ **Headphone Level Selector Switch [HEADPHONE LEVEL]**
This switch sets the headphone volume (high and low).
- ⑥ **Auto OFF Light [AUTO OFF]**
When illuminated, this light indicates that excessive moisture is present inside the deck. When something wrong happens inside the deck, this light will flash.
- ⑦ **Power Switch [POWER]**
Press this switch to turn the unit ON. This switch will light. The Tape Counter display will show "0000", and the meters for audio CH1/CH2, video and tracking will light. Press again to turn the unit OFF.
- ⑧ **Headphone Jack [HEADPHONES]**
Permits listening with headphones to the channel or channels selected by the Audio Monitor Output Channel Selector.
- ⑨ **Cassette Compartment**
For insertion of a cassette tape.
- ⑩ **Safety Switch**
This is the switch for safety guard for protecting your finger from being pinched between a cassette and switch. If this switch is touched while the cassette compartment is going down, the cassette compartment will stop and raise again.

- ⑪ **Frame Lock Light [FRAME LOCK]**
This light indicates when H phase of the video input signal matches that of playback video. Before trying to edit, be sure to adjust the Horizontal Phase Adjust with the Frame Servo Switch ON so that this light is on.
- ⑫ **Servo Lock Light [SERVO LOCK]**
This light is on when the servo circuit is synchronized with a standard signal. Make sure that this light is ON before editing.
- ⑬ **Time Code Light [TIME CODE]**
This light is on when the time code signal is used. When this light is extinguished or goes on and off, it indicates that the time code signal is not recorded on the tape.
- ⑭ **Stand-by Light [STAND BY]**
The Stand-by Light is "ON" while the cassette tape is loading or unloading.
- ⑮ **Skew Control [SKEW]**
Move this control to "L" when an slight bend occurs on the right upper part of the playback picture. Move this control to "R" when an slight bend occurs on the left upper part of the playback picture.
- ⑯ **Tracking Control/Meter [TRACKING]**
Normally leaves this in its center "FIX" detent position. Occasionally tapes made on other video cassette recorders may exhibit noise or streaks in the playback picture. Adjust the Tracking Control so that the Tracking Meter reads maximum (green).
- ⑰ **Audio (CH1) Level Control/Meter [AUDIO LEVEL CH1]**
Controls the audio CH1 recording level. Should be adjusted so that the Level Meter needle rarely deflects beyond the 0 dB position. When the Time Code Track Selector on the rear panel is set to "AUDIO", the meter light will be extinguished because the audio CH1 cannot be used.
- ⑱ **Audio (CH2) Level Control/Meter [AUDIO LEVEL CH2]**
Controls the audio CH2 recording level. Should be adjusted so that the Level Meter needle rarely deflects beyond the 0 dB position.
- ⑲ **Video Recording Level Control/Meter [VIDEO LEVEL]**
When Video Recording Level Selector is set at MAN., turn this control to adjust the video recording level while visually referring to the Level Meter. Adjust the recording level to the blue region of the meter.

②0 Input Signal Selector [INPUT SELECT]

TV: To record from the TV monitor connected to the TV Monitor Connector.

LINE: To record from the video camera or video signal connected to the Video Input Connector.

DUB: To do dubbing or editing with the dubbing cable (7-pin), or video cable (BNC).

②1 Audio Limiter Selector [AUDIO LIMITER]

ON: During recording, minimizes distortion from peak levels.

OFF: Peak levels are not limited.

②2 Video Recording Level Selector [VIDEO LEVEL]

MAN: Adjust the video recording level with Video Recording Level Control.

AGC: Video recording level is adjusted automatically.

Insert Editing Selectors ②3, ②4, ②5

Press each selector to enable that function. The selector itself will light.

②3 Audio (CH1) Insert Selector Button [CH1]

This enables audio CH1 record during insert editing.

②4 Audio (CH2) Insert Selector Button [CH2]

This enables audio CH2 record during insert editing.

②5 Video Insert Selector Button [VIDEO]

This enables video record during insert editing.

②6 Record Button [REC]

This button should be pressed simultaneously with the Play Button to start recording both video and audio.

②7 Edit Button [EDIT]

To assemble edit press this button while pressing the Record Button. For insert editing, press this button while pressing the Cut In Button.

②8 Cut In Button [CUT IN]

To start insert editing, press the Edit Button while pressing this button.

When this button alone is pressed, sound and picture for insert editing appear on the TV monitor.

②9 Cut Out Button [CUT OUT]

To end insert editing, press this button.

③0 Chroma Level Control [CHROMA LEVEL]

Used to adjust the chrominance level if the proportion of chroma to luminance is not normal. This should be adjusted with a waveform monitor or oscilloscope. Set this at center detent position under normal conditions.

③1 Head Amp Frequency Adjust [HEAD AMP FREQ ADJ]

Turn to the right to sharpen the picture and turn to the left to soften the picture.

Set this at center detent position under normal conditions.

③2 Horizontal Phase Adjust [H PHASE]

Adjusts the phase of the video input signal and playback video signal for editing.

③3 Frame Servo Switch [FRAME SERVO]

ON: Turn the switch ON to record or edit 2:1 interlaced standard signal.

Frame Lock Light is ON in this position.

If this light is not on, adjust the Horizontal Phase Adjust.

OFF: Turn the switch OFF to edit playback signals from non-frame locked (non interlaced RS-330 signals).

Frame Lock Light is OFF in this position.

③4 Video Mode Selector [VIDEO MODE]

Selects B/W or Color signal.

AUTO: Distinguishes automatically between Black & White and Color video input signals or playback video signals.

Normally, set this selector in this position.

B/W: Makes video input signal or playback video signal black and white.

③5 Pause Button [PAUSE]

Press this button to stop the tape movement in either the record or playback modes, and the pause lamp lights. A still picture will appear in the playback mode if the proper tape is used. See page 8 for details. Press again to release pause.

③6 Rewind Button [REW]

When this button is pressed, the cassette tape is rewound rapidly to the supply reel.

③7 Play Button [PLAY]

Pressing this button causes the tape to start playback. If Record Button is held down first, and then this button is pressed, the unit will go into recording mode.

③8 Fast Forward Button [FF]

When this button is pressed, the tape is forwarded rapidly to the takeup reel.

③9 Eject Button [EJECT]

To insert or remove a cassette tape, press this button, and the Cassette Compartment will be elevated.

If this button is pressed while the tape is moving, (during playback, fast forward or rewind) the unit will stop and then eject.

④0 Stop Button [STOP]

Used to stop the tape movement.

REAR

④① Time Code Connectors [TIME CODE]

Use this connector to record or read out the time code signal.

IN: Connection point for Time Code recording.

OUT: Connection point for Time Code playback.

④② Time Code Track Selector [TIME CODE TRACK SELECT]

This is used to select either the audio CH1 or the address track on the tape for recording or playing back the time-code signal.

When it is desirable to record or play back the time-code signal on the ADDRESS tape track, set the selector to the "TIME CODE" position.

When desired to record or play back the time-code signal on the AUDIO CH1 tape track, set the selector to the "AUDIO" position.

④③ 75Ω Terminator Switch [75Ω]

This is the termination switch for the video signal.

ON: To terminate the video signal.

OFF: Bridging.

④④ Audio Input Level Selector [LEVEL]

This is the level selector for the audio input. For microphone (low level) input, set the selector to the "LOW" position.

For line (high level) input, set the selector to the "HIGH" position.

④⑤ Impedance Selector [600Ω]

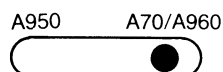
This is the impedance selector for audio input.

For an audio low impedance input, set the selector for the "ON" position.

For an audio high impedance input, set the selector for the "HIGH" position.

④⑥ Controller Selector Switch [CONTROLLER SELECT]

Use this switch to select the type of Editing Controller.



A950: Set the switch to this position to use Editing Controller NV-A950.

A70/A960: Set the switch to this position to use Editing Controller AU-A70 or Editing Controller NV-A960.

④⑦ Remote Control Connector [REMOTE]

For connection to an Editing Controller (NV-A950/ NV-A960) or Editing Controller (AU-A70), or Remote Control Unit NV-A152.

④⑧ Audio Input Connectors CH1 & CH2 [AUDIO IN]

This is the connector for accepting an audio input signal from a microphone or line source (audio tape recorder, radio or record player).

④⑨ Video Input Connector [VIDEO IN]

For connection of the video camera or video signal.

⑤① Sync In Connector [SYNC IN]

To synchronize to an external sync source, connect external standard composite sync signal to this connector.

⑤② Sub Carrier Connector [SC IN]

When a time base corrector is used with this unit, connect the subcarrier output of the time base corrector to this connector.

⑤③ Dub In Connector [DUB IN]

Receives signal from the Dub Out Connector of the play VCR via the 7-pin dubbing cable (accessory included).

⑤④ TV Monitor Connector [TV]

For connection of a TV monitor (having an 8-pin connector) by using the VTR-monitor connection cable. For audio, only CH2 is available at the 8-pin connector.

⑤⑤ DOC Switch [DOC]

The Dropout Compensator On and Off switch. Place this switch in "OFF" position when the Time Base Corrector has an internal DOC and is connected to the RF Output Connector.

This eliminates double dropout compensation in both VCR and TBC.

⑤⑥ RF Output Connector [RF OUT]

To be connected to a Time Base Corrector which is equipped with Dropout Compensator.

Output signal: RF signal, 0.5Vp-p at 75 ohm terminated.

⑤⑦ Video Output Connector 1 [VIDEO OUT 1]

Video Output Connector 2 [VIDEO OUT 2]

These connectors allow to use video output signal with the TV monitor, video recorder, or time base corrector at the same time if required.

⑤7 **Ground Terminal [GND]**

Connect to external ground, if audio hum or buzz is heard while monitoring or playing back.

⑤8 **Ventilation Hole**

⑤9 **Voltage Selector [VOLTAGE SELECT]**

This selector can be set for 100, 120, 220, 240 Volt operation.

If it is necessary to change the voltage (preset to 120V at the factory), consult page 1.

⑥0 **AC Power Input Connector [AC IN]**

Connect the power cord between this connector and an AC power outlet.

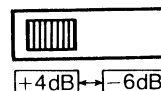
⑥1 **APC Adjust [APC]**

This control is preset at factory, and under normal operating conditions it will not require any adjustment. If the playback picture shifts in hue or completely loses all color, try turning the recessed control slowly to the right or left with a flat blade screwdriver until a normal color picture reappears.

⑥2 **Audio Output Connectors CH1 & CH2 [AUDIO OUT]**

Audio signal line out.

(If the TOP Panel is removed from the unit, an audio output level can be selected in either +4 dB or -6 dB.)



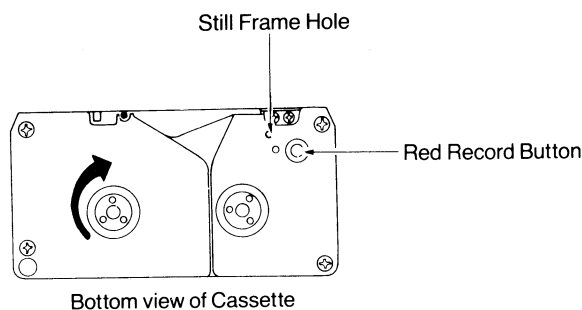
⑥3 **Dub Out Connector [DUB OUT]**

Sends signal to the Dub In Connector of the recording VCR via the 7-pin dubbing cable (accessory included).

⑥4 **Audio Monitor Output Jack [AUDIO MONITOR]**

For connection to audio amplifier, or audio input of a TV monitor, this allows monitoring of channel 1 or channel 2 or mixed audio, as selected by the Audio Monitor Output Channel Selector.

VIDEO CASSETTE IDENTIFICATION



The bottom of a video cassette has several holes to identify functional capability.

Large hole with removable red button

This hole determines whether a video cassette can be used for recording and playback, or for playback only, depending upon whether the red button is placed.

■ Red button inserted into large hole.

If the red button is inserted into the large hole, then the video cassette can be used for recording, playback and audio dubbing.

■ Red button removed from large hole.

If the red button has been removed from the large hole, then the video cassette can be used for playback only. This is a special feature which prevents accidental erasure of a pre-recorded program.

Still-frame playback hole

Panasonic's present cassettes use 3/4" video tape capable of withstanding the tape wear encountered during still frame operation. Some 3/4" video cassette tape was not designed for this type of operation. When such tape is played back and the Pause Button is pressed, rather than allowing the video heads to be clogged, tape tension is released, and no still image appears. The recorder automatically determines whether a particular video cassette is capable of still frame playback.

How to identify video cassette

■ Video cassette designed for still frame playback.

A video cassette designed for still frame playback has two small holes near the large record hole. Such a cassette tape will produce a still image when the Pause Button is pressed during playback.

Caution:

If the PAUSE mode is left for more than 10 minutes, the unit will automatically go into the stop mode, to protect the tape.

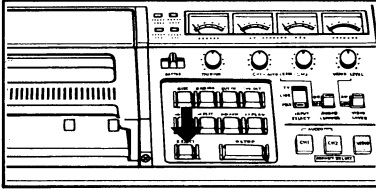
■ Video cassette not designed for still frame playback.

A video cassette not designed for still frame playback has one small hole near the large record hole. Such a cassette tape will not produce a still image when the Pause Button is pressed during playback. Tape motion will stop and normal playback will resume when the Pause Button is pressed again.

FUNDAMENTAL OPERATIONS

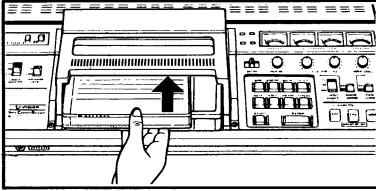
■ How to insert the cassette tape

(1) Press the Eject Button



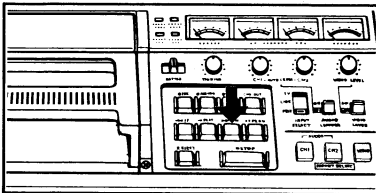
Press the Eject Button and the Cassette Compartment will be gently elevated.

(2) Insertion of the cassette tape



Insert the cassette tape fully into the Cassette Compartment.

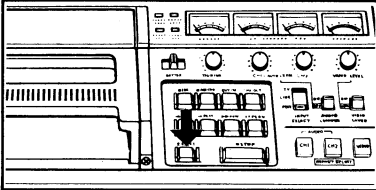
(3) Lower the cassette tape for operation



Press the Rewind Button. Then the cassette tape will lower and the tape will be rewound to the reel on the right (the supply reel). It will automatically stop at the beginning of the tape.

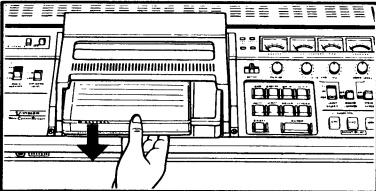
■ How to remove the cassette tape

(1) Press the Eject Button



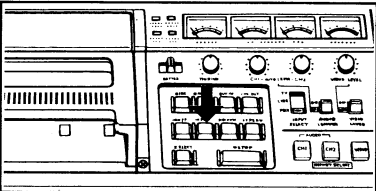
To exchange or remove a video cassette tape, press the Eject Button while operating in any mode and the Cassette Compartment will be gently elevated for easy removal of the cassette tape.

(2) Remove a video cassette tape



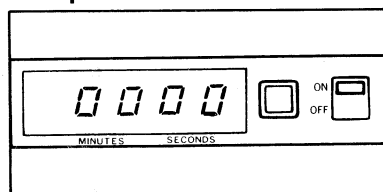
After the Cassette Compartment is elevated completely, remove the video cassette tape.

(3) Lower the Cassette Compartment



If either the Play, Rewind or Fast Forward Button is pressed the Cassette Compartment will lower, even if no cassette is installed.

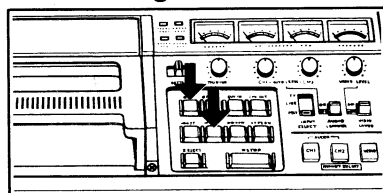
■ Tape Counter



This tape counter will count and display CTL pulses in accordance with tape movement. When the Reset Button is pressed, the counter display will be "0000". When the Memory Switch is set to "ON" position, the tape will automatically stop during rewind or fast forward when the Tape Counter display indicates nearly "0000".

By starting the recording from this "0000" point, subsequent playback will be more convenient.

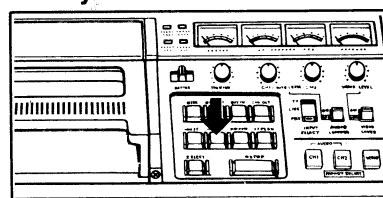
■ Recording



Press the Play Button while pressing the Record Button.

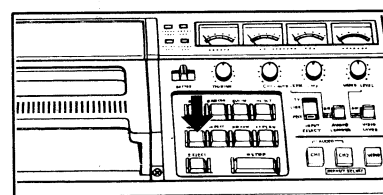
Video and audio recording is made immediately after the Stand-by Light goes off. When the tape reaches its end, it will automatically be rewound by the automatic-rewind system.

■ Playback



To play back the tape, press the Play Button and the Stand-by Light will glow while the cassette tape is loading. After a few seconds the light will go out, and playback will begin. The picture will then appear on the TV monitor.

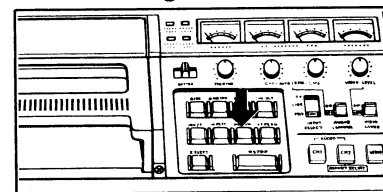
■ Fast forward



The Fast Forward Button can be used to rapidly advance the tape to the position desired for playback or recording.

If an input signal is present during Fast Forward, the E-E picture will appear on the TV monitor.

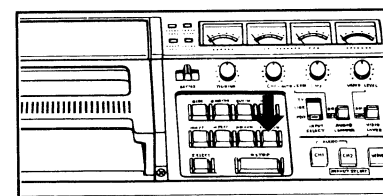
■ Rewinding



When the Rewind Button is pressed, the tape is rewound to the reel on the right (the supply reel).

If an input signal is present during Rewind, the E-E picture will appear on the TV monitor.

■ Pause



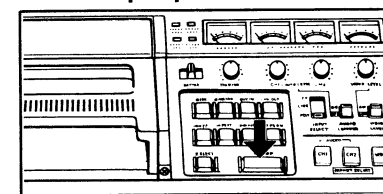
During recording or playback, to momentarily stop the tape, press the Pause Button. During record, while the tape has stopped, recording cannot be performed. During playback, while the tape has stopped, either a still image will appear, or the picture will be muted. This depends upon the type of tape used. See page 8 for details. To resume recording or normal playback, press the Pause Button again.

Recording or playback will immediately resume.

Note:

If the Pause mode is left for more than 10 minutes, the unit will automatically go into the stop mode, to protect the tape.

■ To stop tape movement



To stop all other functions, press Stop Button.

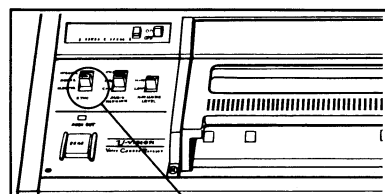
If input signal is encountered in this mode, the E-E picture will appear on the TV monitor.

ADJUSTMENT BEFORE RECORDING, PLAYBACK AND EDITING

Be sure to set the recorder to STOP mode (E-E picture) before trying to adjust the following switches.

■ SYNC MODE SELECTOR

The Sync Mode Selector is used to determine the source to which the VCR is synchronized during Record, Playback, and Editing.



INTERNAL
NORMAL
EXTERNAL
SYNC

1. INTERNAL: The tape is synchronized with internal 60 Hz oscillator (derived from internal crystal source). This mode is primarily used for playback.

2. NORMAL: The tape is synchronized with the input video signal. This mode is used for normal recording, playback and editing.

Notes: (1) If during playback, the input video signal is noisy or unstable, switch to the "INTERNAL" position.

(2) If during playback, there is no input video signal, synchronization automatically switches to internal.

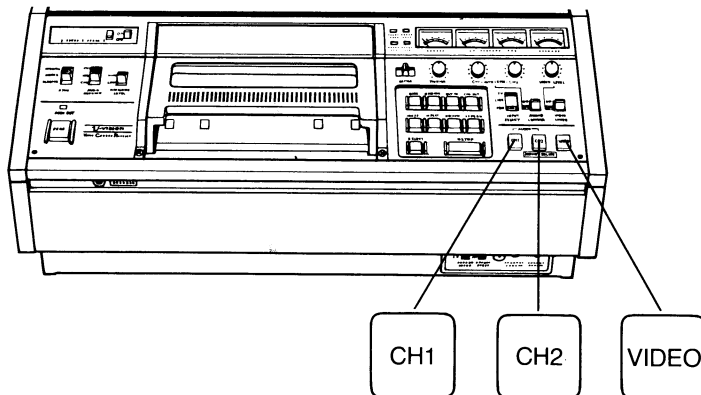
3. EXTERNAL: The tape is synchronized with the external composite sync which is connected to the Sync In Connector on the rear panel. For better editing stability, synchronize with an external composite sync signal.

However, whatever signal is being recorded, must be in phase with the external composite sync signal. Otherwise the recording will be useless.

■ INSERT SELECTOR BUTTONS

For insert editing, the following combinations of video, audio CH 1 and CH2 can be selected.

Press each button to enable this mode and the selected button lights.

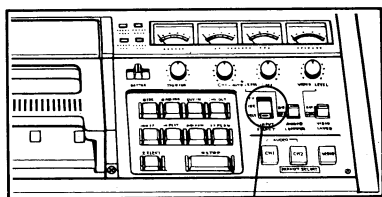


Signal to be Edited	Position of Insert Selector Buttons			Remarks
	Video	Audio CH 1	Audio CH 2	
Video only	ON	OFF	OFF	
Video and Audio CH 1	ON	ON	OFF	
Video and Audio CH 2	ON	OFF	ON	
Video and Audio CH 1 & 2	ON	ON	ON	
Audio CH 1 and CH 2	OFF	ON	ON	Audio dubbing
Audio CH 1	OFF	ON	OFF	Audio dubbing
Audio CH 2	OFF	OFF	ON	Audio dubbing

■ INPUT SIGNAL SELECTOR

The Input Signal Selector is used to select the source of audio and video inputs, and also to obtain better color quality for dubbing or video editing.

By setting this selector, the Automatic Phase Control (APC) circuit is enabled or disabled under various conditions during dubbing or editing.



TV
LINE
DUB
INPUT
SELECT

TV: To record audio and video signals from a TV monitor through TV Monitor Connector (8-pin), set the Input Signal Selector to "TV" position.

LINE: To record audio and video signals from an Audio/Video source through Video Input Connector (BNC) and Audio Input Connector (XLR), set the Input Signal Selector to "LINE" position. During recording or playback, the APC and noise eliminator are ON, which corrects the instability of the chrominance portion, giving a good color image for the TV Monitor.

DUB: To do dubbing or editing by using the dubbing cable (7-pin), or video cable (BNC), set the Input Signal Selector to "DUB" position. Under this condition, the APC and noise eliminator are OFF, making the chrominance portion unstable but perfectly interleaved with the luminance portion. This creates less color noise, with the result being a good quality picture (especially on multi-generation tapes) when this signal is recorded by the editing or dubbing machine.

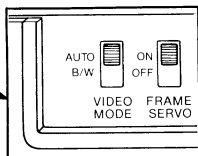
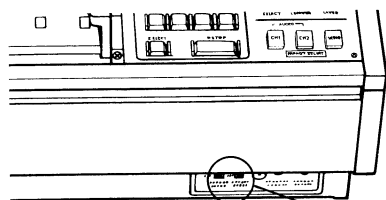
Position of Input Signal Selector	Use of the input source		
	Use of TV	Use of camera	Dubbing/Editing
TV	Recommended	Not recommended	Not recommended
LINE	Not recommended	Recommended	Recommended
DUB	Not recommended	Not recommended	Recommended*

Notes:

●When you want to do dubbing or editing, it is recommended to set the Input Signal Selector at "DUB" position.

*The color presentation of the TV monitor connected to the playback VCR may not come out stable when the BNC type cable is used for video signal, but this is not a malfunction. The final playback of the copied tape will have the proper correction.

■ VIDEO MODE SELECTOR



Set this selector normally at "AUTO" position.

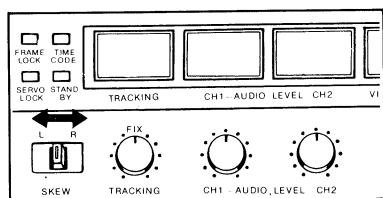
AUTO: To record either Color or Black & White video input signal by distinguishing automatically between them.

B/W: To record all video input signal in the black and white mode.

When playing back a color program on a B/W monitor, color dot interference can be eliminated by setting this switch to B/W.

Note that color programs will play back in the black and white mode if the Video Mode Selector is set to "B/W".

■ SKEW CONTROL



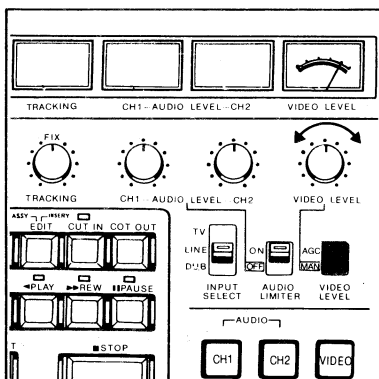
This control is used to correct a slight right or left bend in the upper part of the playback picture.

Stop moving it when the image appears to be corrected.

●Move this control to "L" side when an slight bend occurs on the right upper part of the playback picture.

●Move this control to "R" side when an slight bend occurs on the left upper part of the playback picture.

■ VIDEO LEVEL ADJUSTMENT



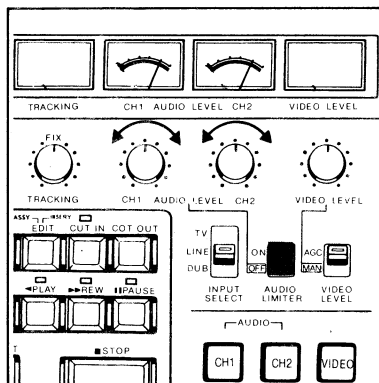
AGC: Automatic Gain Control

Set the Video Recording Level Selector to "AGC" position, and the video recording level is adjusted automatically. In the AGC mode the Video Recording Level Control does not operate. This is the mode normally used for recording.

MAN: Manual Gain Control

Set the Video Recording Level Selector to "MAN" position, and adjust the video recording level with the Video Recording Level Control so the meter points to the blue portion.

■ AUDIO (CH 1/CH 2) LEVEL ADJUSTMENT



Gain Control (ch 1)

Adjust Audio (ch 1) Recording Level Control so the meter rarely deflects beyond 0 dB on peaks.

When the Time Code Track Selector is set to "AUDIO", the audio CH1 cannot be used because the Audio CH1 track of the tape has been selected for recording or playing back of time-code signal.

Gain Control (ch 2)

Adjust the meter rarely deflects beyond 0 dB on peaks.

Note:

When recording from a TV monitor, the audio is recorded on channel 2 only.

Therefore, only Audio (ch 2) Recording Level Control needs to be adjusted.

AUDIO LIMITER SELECTOR

ON: To minimize distortion from peak levels set Audio Limiter Selector to "ON" position. This permits the average level to be set higher for better signal to noise ratio.

OFF: This permits maximum dynamic range to be recorded, but the level must be set low enough so that peaks do not cause objectionable distortion.

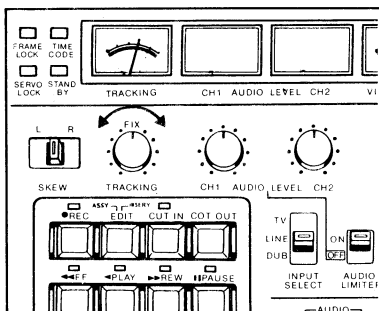
Note:

The Audio Limiter Selector controls both channels simultaneously.

●Playback

Audio level cannot be adjusted during playback with this unit even though the level meter needle indicates the recorded audio level.

■ TRACKING CONTROL



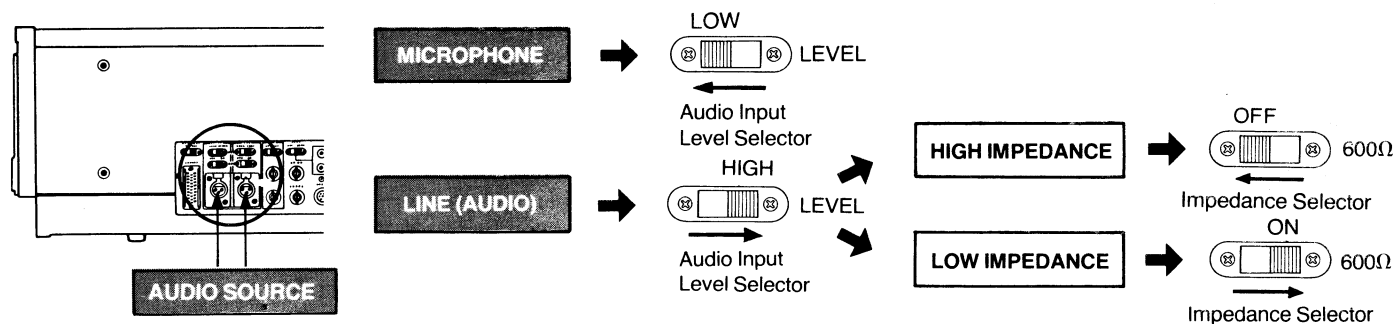
Normally tapes should be played back with the Tracking Control at the "FIX" position.

When playing some non-standard tapes or those recorded on another machine, streaks or noise may appear on the TV monitor. If this occurs, adjust this control. Turn the Tracking Control slowly in either direction until the picture is clear, and the tracking meter indicates maximum.

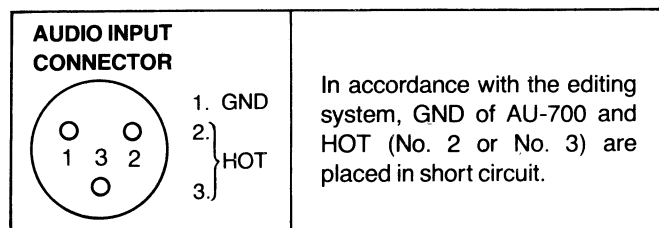
When the appropriate location is determined, leave the control at that position when playing back that tape. When playback of this particular tape is finished, reset the Tracking Control to "FIX".

■ AUDIO INPUT LEVEL/IMPEDANCE SELECTOR

According to the audio input signal source, set these selectors as follows;

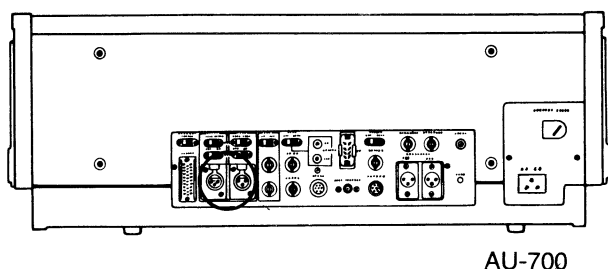


●When the Audio Output RCA Pin Jack (unbalanced) of the Playback Unit is connected to the Audio Input XLR Connector (balanced)



For further full particulars, please refer to the qualified service man.

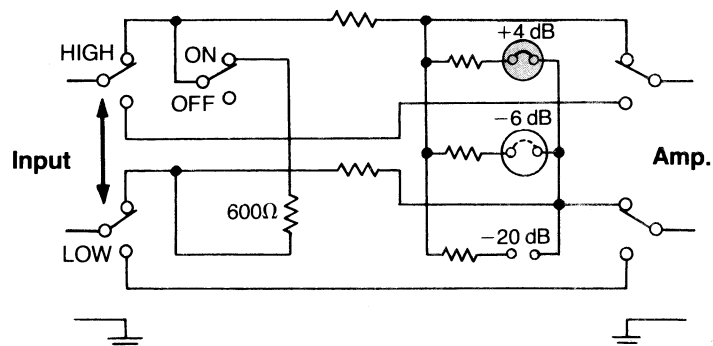
●When the Audio Output Level, -6 dB Video Recorder of the playback unit is connected to the Audio Input XLR Connector (AU-700)



On the back plate which is situated around the Audio Input XLR Connector on the back side of AU-700, you will find the printed circuit board for VJB00585.

Be sure to solder those cut points (No. 2 and No. 5) on the printed circuit board. (Portion shown in series of broken hyphen line.)

Please remember that cut point No. 3 and No. 6 are exempted from being soldered. (Portion shown in shaded area.)

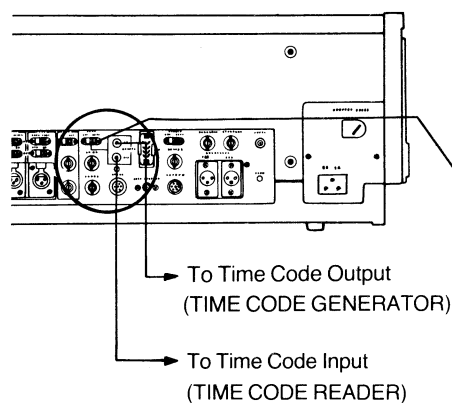


The standard level of the Audio Input shall be changed from +4 dB over to -6 dB.

For further full particulars, please refer to the qualified service man.

■ TIME CODE TRACK SELECTOR

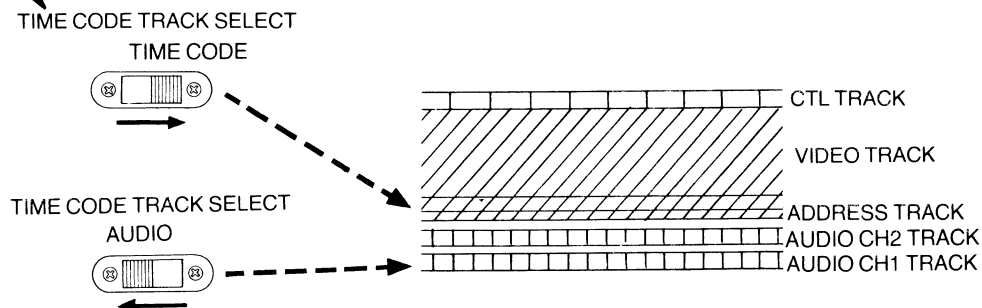
In order to record or play back the SMPTE time-code signal on the selectable tape track (audio CH1 or address track), this selector should be switched at "TIME CODE" or "AUDIO" according to the choice tape track.



If recording or playing back the time-code signal on the tape track **ADDRESS**, set the selector to "TIME CODE". (Audio CH1 Level Meter on front panel is ON.)

In case of recording or playing back the time-code signal on the tape track **AUDIO CH1**, set the selector to "AUDIO". (Audio CH1 Level Meter on front panel is OFF.)

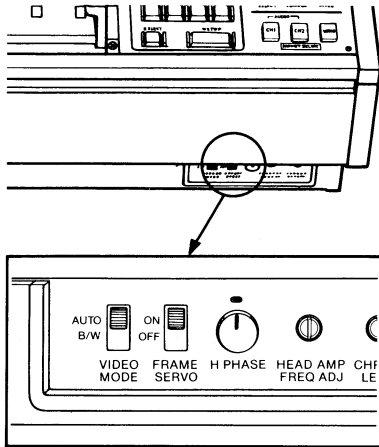
The tape track of the time-code will be recorded as follows;



■ FRAME SERVO SWITCH

The AU-700 is capable of frame-by-frame editing if the following conditions are met:

- The signal of the pre-recorded program meets EIA RS-170A standard (interlaced sync).
- This program was originally recorded by the AU-700, NV-9600 or NV-9240 with Frame Servo Switch ON.
- The new program to be edited also meets EIA RS-170A standard.



ON: When used in REC mode, the frame servo assures that CTL pulses recorded on the tape are unambiguously related to one of the video fields during each frame. In effect, each CTL pulse is processed vertical sync from the even field and not the sync from the odd field. When used in PB mode (if tape to be played back was recorded with this switch in the "ON" position), the frame servo assures that the playback signal and incoming signals are not only phase locked (servo function) but an even field is being played back as an even field enters the VTR and an odd field is played back as the odd field enters the VTR. This lock depends on the fact that the recorded signal and the incoming signals both have RS-170A sync.

OFF: Field-to-field locking ability of the VTR is disabled. This is desirable if the tape to be edited has the wrong relationship between CTL pulse and odd field. This may occur if the tape is made on NV-9400, NV-9200/(A), NV-8200, NV-8170, NV-9500/(A) (with FR DET SW OFF) or AU-700/NV-9600/NV-9240 (with FR SERVO SW OFF). If edits were made in such a tape with FR DET SW or FR SERVO SW in the "ON" position each edit would "flash" at the top during the edit transition.

Under these conditions, if the switch is turned off, the 100% bad edits will result in 50% good edits (on the average).

Note 1: When laying down CTL pulses on the master tape to be ASSY edited or INSERT edited, introduce a signal with RS-170A sync and record with FR DET SW or FR SERVO SW in the "ON" position.

Note 2: When dubbing from a tape, ASSY edited on NV-9400, NV-9500/(A) (with FR DET SW OFF), or AU-700/NV-9600 (FR SERVO SW OFF), leave the FR DET SW or FR SERVO SW in the "OFF" position when the REC VTR is NV-9500/(A) or AU-700/NV-9600 to prevent framing servo hunting.

■ Horizontal sync disturbance during editing

When the vertical sync phase of video signals for playback of a pre-recorded program and the program to be edited (added) are synchronized, the editing can be done without any vertical disturbance on the TV monitor, but the horizontal sync may have a "flash" disturbance at the edited portion. The probability of this disturbance at the edited portion is 50% when the video signal for playback of the pre-recorded program and the edited program both meet EIA standard RS-170A.

This disturbance is caused by misalignment of odd and even fields which differ by 1/2 of a horizontal line. If an odd field is followed by another odd field, or if an even field is followed by an even field, horizontal sync misalignment occurs at the edit point.

To prevent such a "flash" disturbance at the edit points, it is necessary to detect the odd (or even) field and then to synchronize the vertical sync phase.

■ Prior to your editing, be sure to adjust the horizontal sync phase signal of source VCR to be met by that of editing VCR.

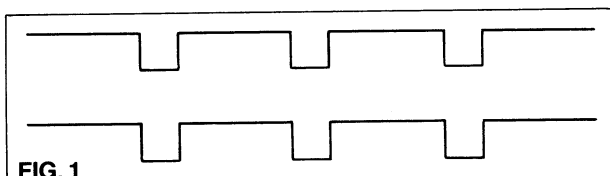


FIG. 1

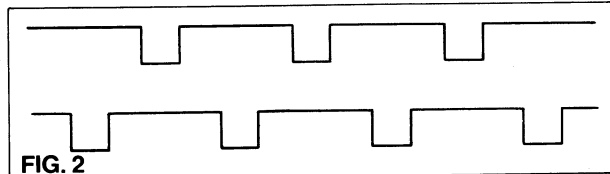
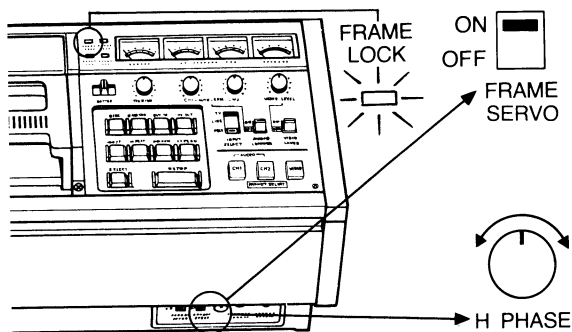


FIG. 2

Fig. 1 shows that the horizontal sync phase of video input picture signal is matched to that of playback picture signal. In this case, the Frame Lock Light on the front panel will be "ON".

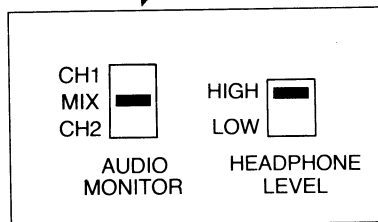
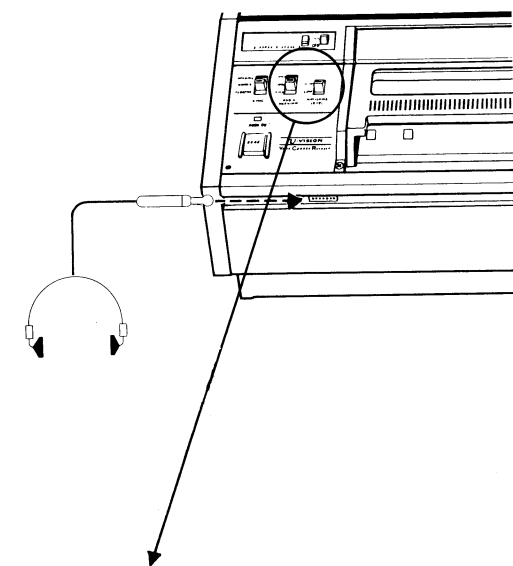
Fig. 2 shows that the horizontal sync phase of video input picture signal is not matched to that of playback picture signal. In this case, the Frame Lock Light on the front panel will be "OFF".

● To adjust the horizontal sync phase of video input signal and playback video signal for editing, do the following;



1. Feed the signal to be edited to the editor unit.
2. Set the Frame Servo Switch of the editing VCR to "ON".
3. Press the Play Button of the editor unit for playing back the tape.
4. Turn the Horizontal Phase Adjust to right or left until the Frame Lock Light on front panel illuminates.

■ AUDIO MONITOR OUTPUT CHANNEL SELECTOR and HEADPHONE LEVEL SELECTOR



● AUDIO MONITOR OUTPUT CHANNEL SELECTOR

The Audio Monitor Output Channel Selector is used to select the audio output signal. Its selected signal is heard on the TV monitor or headphones.

● If the Time Code Track Selector is set to "AUDIO" . . .
(Time-code signal will be recorded or played back on tape track of AUDIO CH1.)

No audio sound can be heard, even if the Audio Monitor Selector is set to "CH1". Set this selector to "MIX" or "CH2" in order to hear audio sound CH2.

● If the Time Code Track Selector is set to "TIME CODE" . . .
(Time-code signal will be recorded or played back on the ADDRESS tape track.)

Please set the Audio Monitor Selector to the desired position.

Note:

In the "TIME CODE" position, if a tape which has been recorded with the time-code signal on the AUDIO CH1 track is played, turn the Audio Monitor Selector to "CH2". If you set this selector to "CH1" or "MIX", you will hear a shrill, abnormal sound.

● HEADPHONE LEVEL SELECTOR

When using headphones, volume level can be "HIGH" or "LOW" by using the Headphone Level Selector.

Setting of Audio Monitor Output Channel Selector	TV Monitor Connector Audio Monitor Output Jack	Headphone Jack
Channel 1	Audio from channel 1 only	Audio from channel 1 only
MIX	Sound from both channels will be mixed	(Not mixed) Each headphone hears separate channel Channel 1 . . . Left Channel 2 . . . Right
Channel 2	Audio from channel 2 only	Audio from channel 2 only

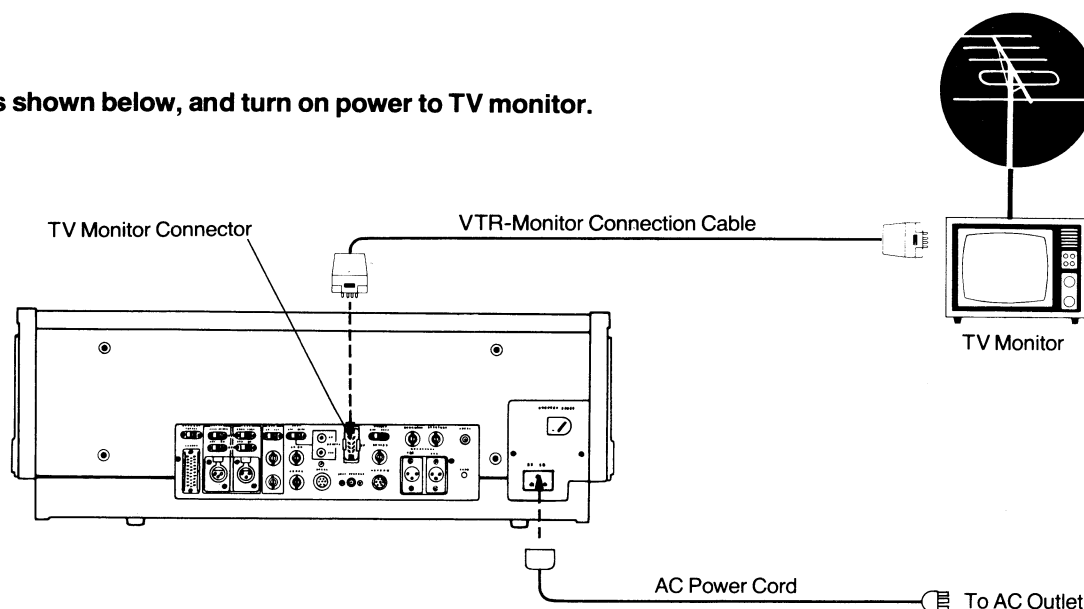
Note:

When using the Audio Output Connectors CH1/CH2, both audio signals are not affected by the Audio Monitor Output Channel Selector setting, and are independent.

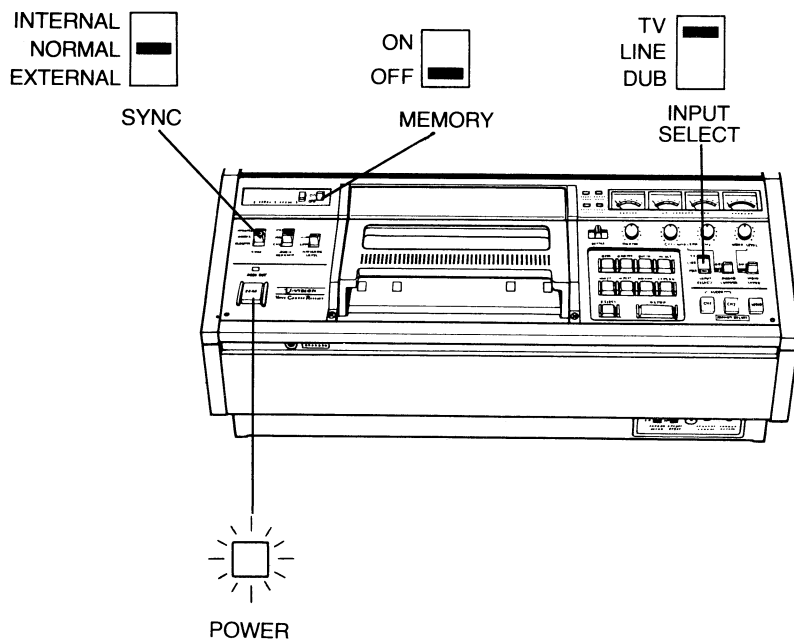
RECORDING/PLAYBACK PROCEDURE WITH A TV MONITOR

PROCEDURE

1. Make connections as shown below, and turn on power to TV monitor.



2. Set each switch as shown below and press the Power Switch to turn on.

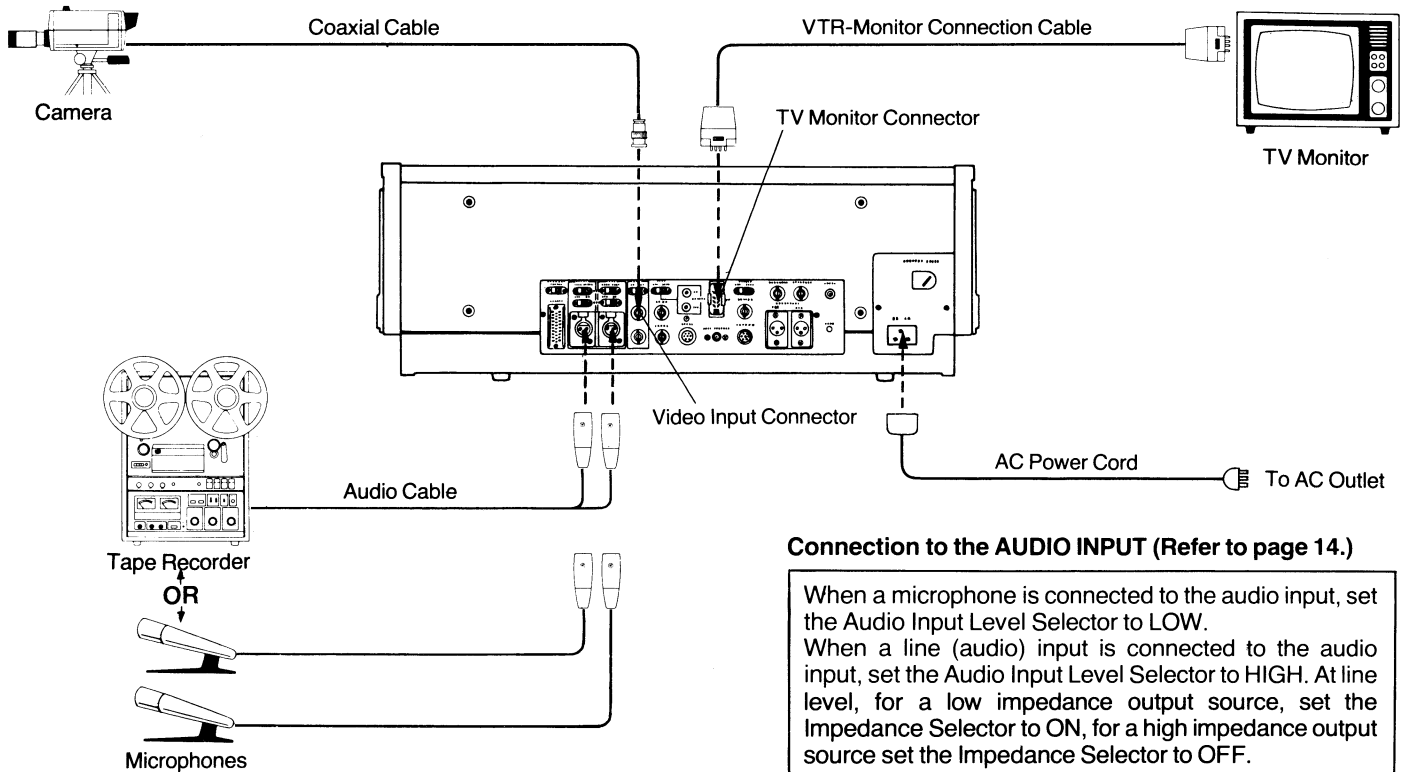


3. Insert the cassette tape.
4. Select the desired TV program.
5. Adjust the Video level, or set Video Recording Level Selector to AGC.
6. Adjust the Audio (CH2) level, or set Audio Limiter Selector to ON.
7. Perform RECORDING, PLAYBACK, PAUSE, REW, FF and STOP as desired according to the Fundamental Operation, page 10.

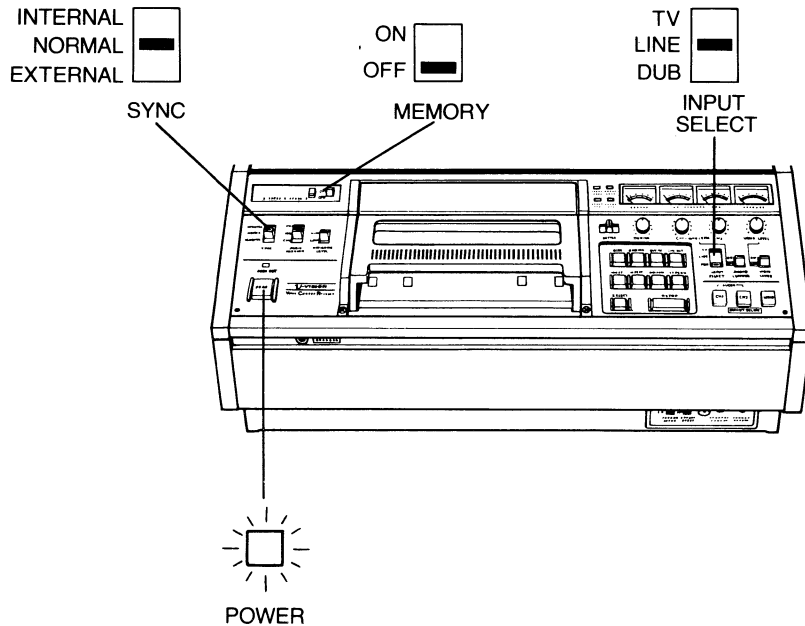
RECORDING/PLAYBACK PROCEDURE WITH A VIDEO CAMERA

PROCEDURE

1. Make connections as shown below, and turn on power to TV monitor.



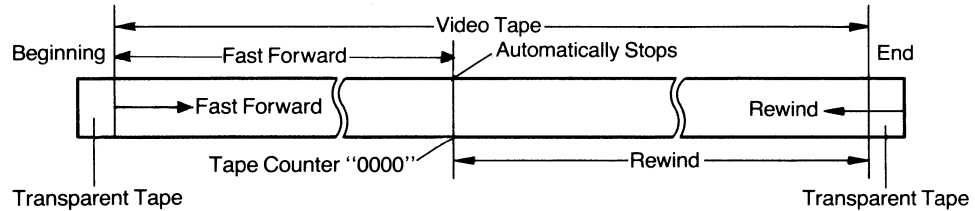
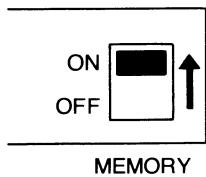
2. Set each switch as shown below and press the Power Switch to turn on.



3. Insert the cassette tape.
4. Connect the desired camera and Audio set-up at the studio.
5. Adjust the Video level, or set the Video Recording Level Selector to AGC.
6. Adjust the Audio (CH1/CH2) level, or set Audio Limiter Selector to ON.
7. Perform RECORDING, PLAYBACK, PAUSE, REW, FF and STOP as desired according to the Fundamental Operation, page 10.

AUTOMATIC SEARCH

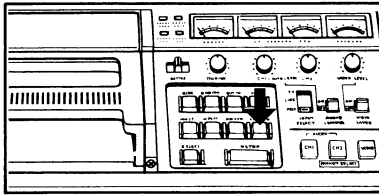
When the Memory Switch is set to the "ON" position, the tape will automatically stop during rewind and fast forward when the tape counter display indicates nearly "0000".



1. Locate the desired position of the tape.
2. Set the tape counter to "0000" by pressing the Tape Counter/Reset Button at desired point for recording/playback.
3. Set the Memory Switch to "ON".
4. Now whenever in the fast forward or rewind modes, the tape will automatically stop at the desired spot.

PAUSE OPERATION

Press the Pause Button for still pictures during playback, or for momentary pause during recording.



■ Still mode

During playback, when the Pause Button is pressed and the proper tape is used, a still image will appear. See page 8 for details. To resume playback, press the Pause Button again.

■ Simple electronic gathering (editing)

1. To record a program B after the pre-recorded program A, first, playback the program A.
2. Press the Pause Button at the point where it is desired to join program A and B. A still image of program A will appear, if the proper tape is used.
3. Press the Record Button and adjust the video level or select AGC.
4. To begin recording, press the Pause Button again, and program B will start being recorded.

■ Stop during recording

1. During recording, to stop the tape, press Pause Button. While the tape has stopped, recording cannot be performed.
2. To resume recording, press the Pause Button again.

CAUTION:

If the Pause mode is left for more than 10 minutes, the unit will automatically go into the stop mode.

USING THE AU-700 IN CONJUNCTION WITH A TIME BASE CORRECTOR

The AU-700, with its Direct Drive Head Cylinder and Capstan Servo system, produces a picture with a minimum of time base instability (jitter). This time base instability can be further reduced by using a time base corrector (not available from Panasonic). The video signal produced by the AU-700 can be thought of as consisting of a chrominance (color) portion, and a luminance (black and white or brightness) portion. Normally, an Automatic Phase Control (APC) circuit within the VCR removes all phase instability from the chrominance portion of the video signal. The luminance portion is untreated, and so it is this part of the video signal which has time base instability. Strictly speaking, the exact relationship between the chrominance and luminance portions (called interleaving) is not preserved by the VCR. This condition is common to all helical scan video tape recorders.

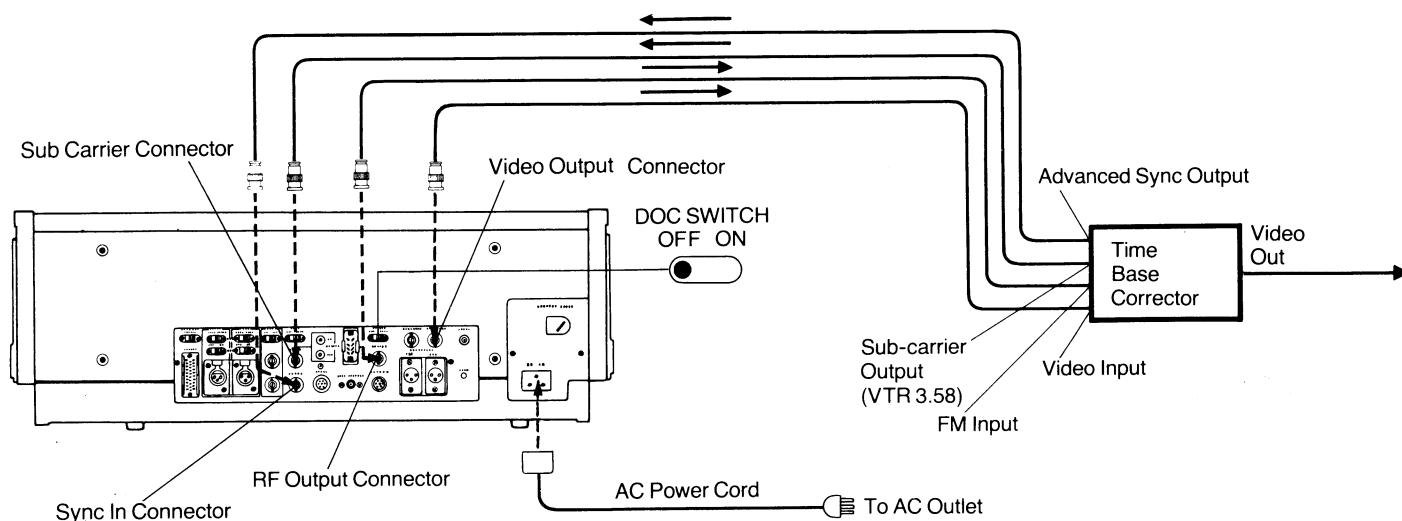
Many time base correctors allow the interleaving relationship

of chrominance and luminance to be preserved. Such a time base corrector develops a subcarrier output signal (VTR 3.58) which if connected to Sub Carrier Connector of the AU-700, serves as a reference for the APC circuit. This results in a video signal from the output of the time base corrector with almost no time base instability and nearly perfect interleaving of chrominance and luminance.

The time base corrector may be equipped with a dropout compensator to minimize the dropouts in the incoming video signal. The model AU-700 supplies an RF video signal which is directly amplified from the video heads, enabling the time base corrector to function as a dropout compensator. By setting the DOC Switch provided on VCR at "OFF" position, the dropout compensator in the time base corrector will work to minimize dropouts.

1. Connecting the Time Base Corrector

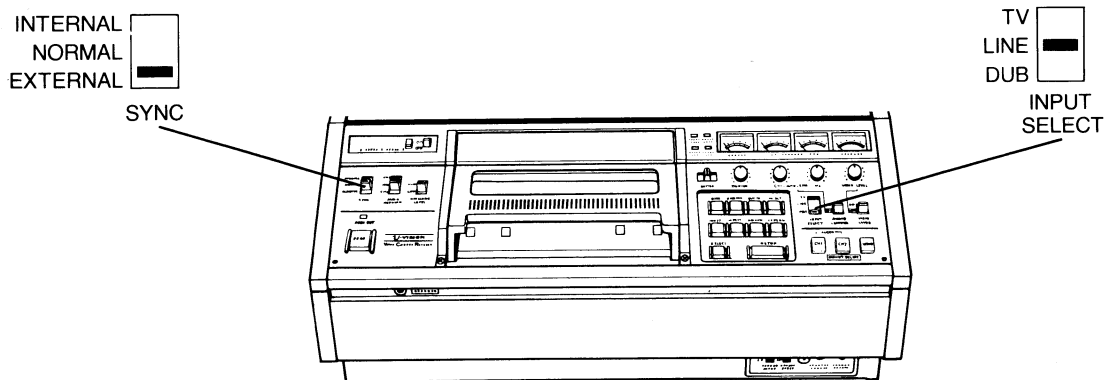
Connect the time base corrector (not available from Panasonic) as shown below.



Note:

It is recommended that DOC Switch be set at the "ON" position if the TBC does not have provision for dropout compensation.

2. For normal Playback set each switch as shown below. Use this unit as part of an editing system.



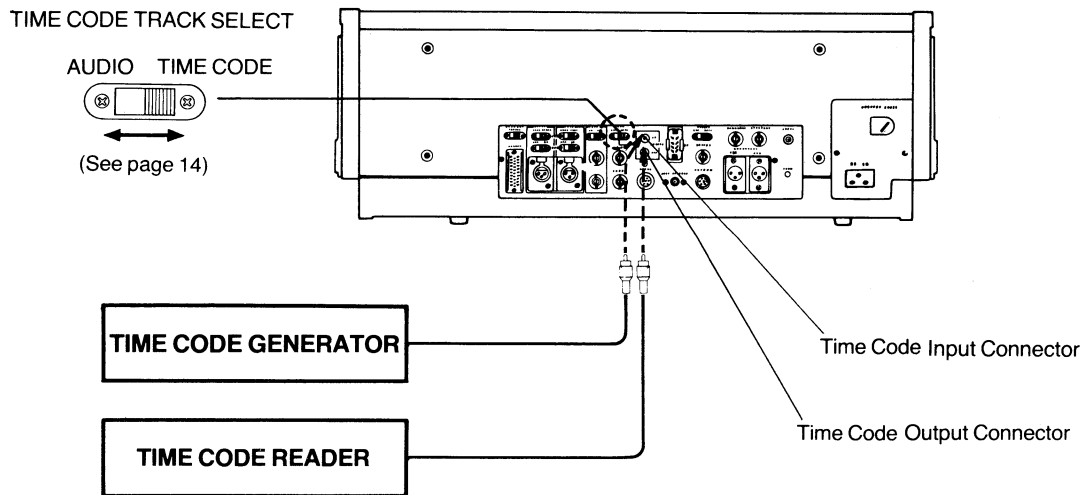
Notes:

1. With the Input Signal Selector set at "LINE", the APC and the noise eliminator circuits within the VCR function. This is desired regardless of whether the time base corrector provides a VTR 3.58 output.
2. With the Sync Mode Selector set at "EXTERNAL", the AU-700 is locked to the advanced sync signal developed in the TBC. The time base corrector inserts a certain amount of delay for the video information, and by locking the AU-700 to advanced sync, proper phase with respect to vertical sync is maintained at the output of the time base corrector.
3. If it is desired to lock to an external sync source when using a time base corrector, connect the external sync output of the time base corrector only, not to the AU-700. The advanced sync output of the time base corrector should then drive the AU-700 as explained in note 2. Consult the instructions for the time base corrector should questions arise.

ABOUT THE TIME CODE

When the time-code signal is recorded on the tape, the absolute address of the tape can be obtained. As the SMPTE time-code signal can be recorded on either the audio CH1 tape track or the address track, select the desired time-code track by switching the Time Code Track Selector. (See page 14.)

In order to record SMPTE time-code signal, connect SMPTE time code generator/reader as follows;

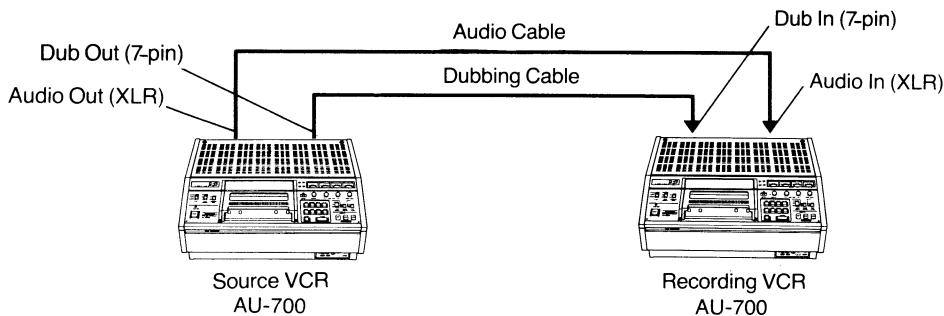


DUBBING SYSTEM

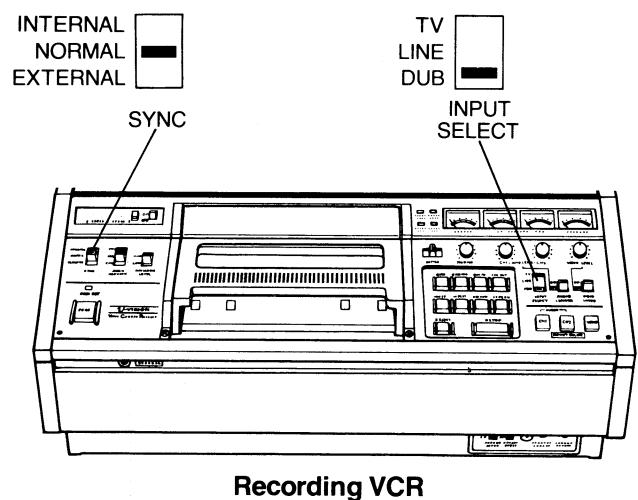
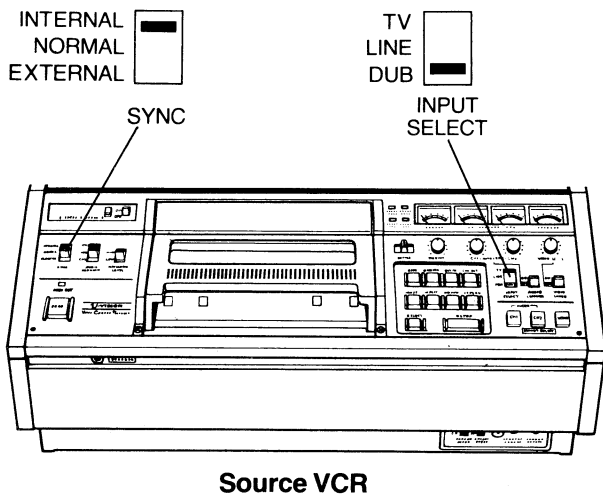
Two AU-700 VCR's can be used for duplicating tapes (dubbing).

Basic Dubbing System

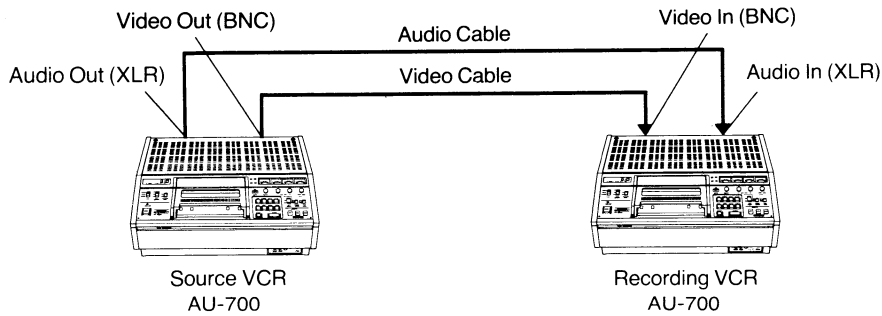
1) When Dubbing Cable (7-pin) is used



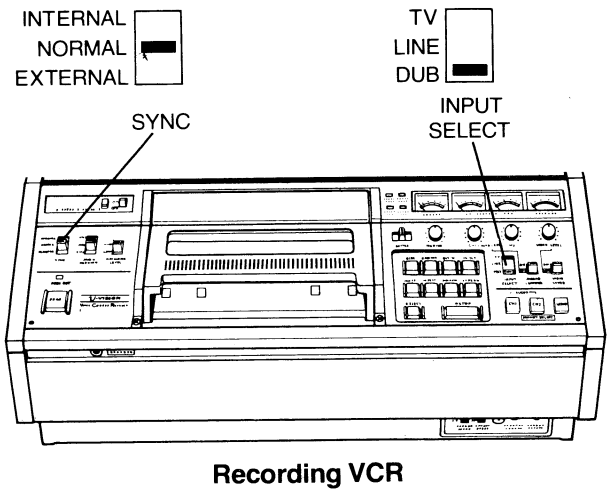
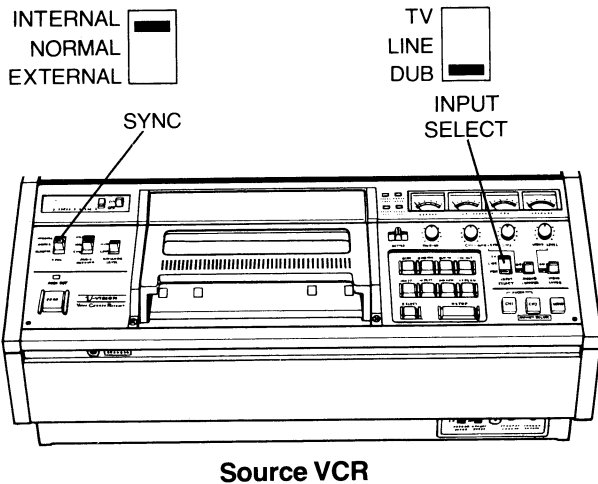
Set each switch as shown below.



2) When BNC video cable is used



Set each switch as shown below.



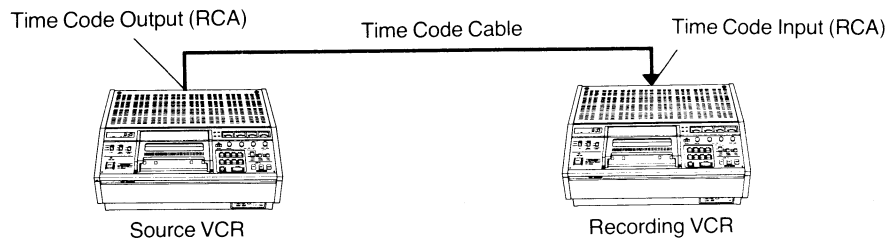
Note:

With the Input Signal Selector for the source VCR is set to "DUB", the APC circuit for the source VCR does not function. Therefore, the chrominance portion will have the same instability as the luminance portion of the output signal, and the two portions will be perfectly interleaved, and this is the way it will be recorded by the recording VCR.

Ultimately, when the tape is played back, the chrominance portion will pass through the APC circuit of whatever VCR it is played back upon, removing chrominance instability. However, since the chrominance and luminance information actually recorded on the tape was interleaved (APC and the noise eliminator circuits of source machine were shut off), the final playback will show less color noise and good quality picture.

3) Recording of Time Code

In order to transfer the time code from the source VCR to the recording VCR, connect as follows;



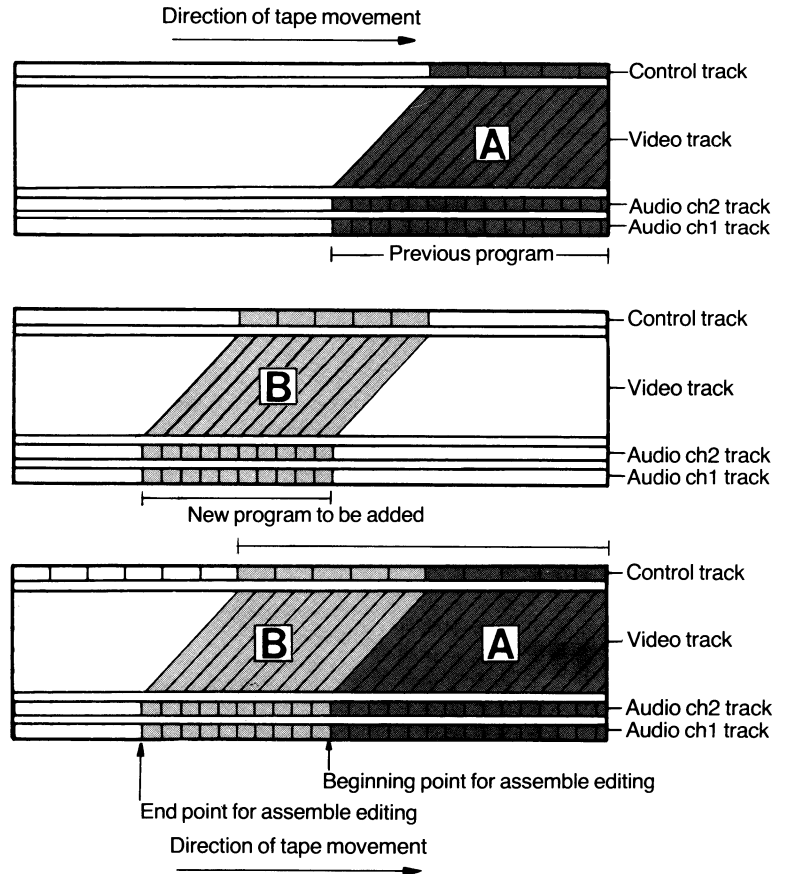
For selection of the time-code track, refer to page 14.

ELECTRONIC EDITING

Electronic editing is a system which permits the user to "edit" an already recorded tape, adding new video and audio portions to the existing program without resulting in visible disruption at the points where the new material is added. There are two types of electronic editing: "assemble editing" and "insert editing".

■ Assemble editing

"Assemble editing" permits the user to add program material to the end of a previously recorded portion, thus making one continuous, uninterrupted program from two programs. Video and audio ch1 and ch2 are all edited at the same time. As shown in the illustration, suppose that part "A" had been previously recorded. To this, a new program "B" is added. This results in a new program consisting of "A" and "B".

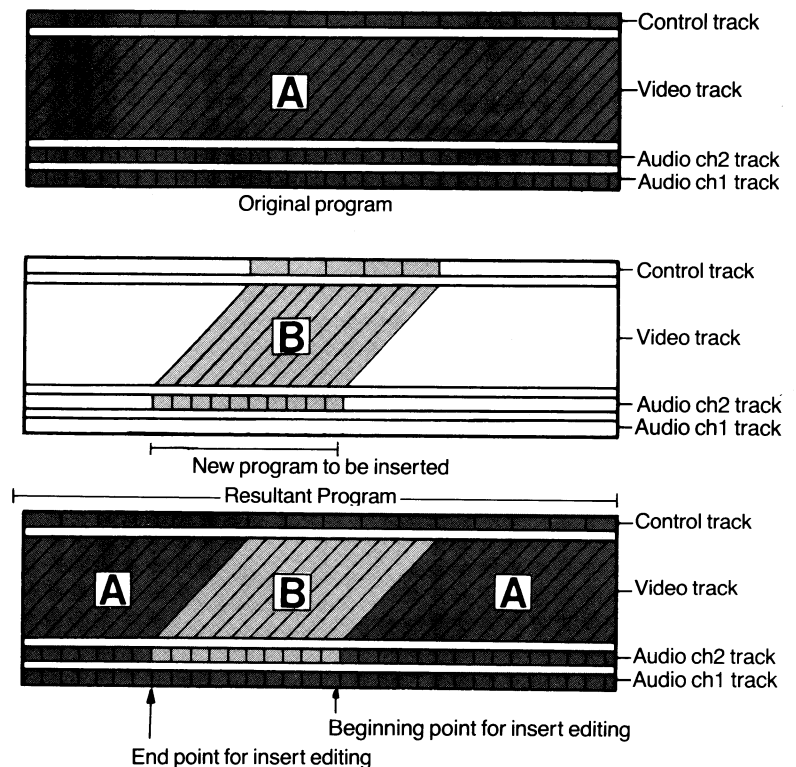


■ Insert editing

"Insert editing" permits the user to add program material somewhere in the middle of a previously recorded portion. As shown in the illustration, the new program material "B" is added between parts of the already-recorded material "A". The result is a new program consisting of parts "A", "B", "A". For insert editing it is possible to insert only video, audio ch1, audio ch2, or any combination of these. See page 11 for details.

Note:

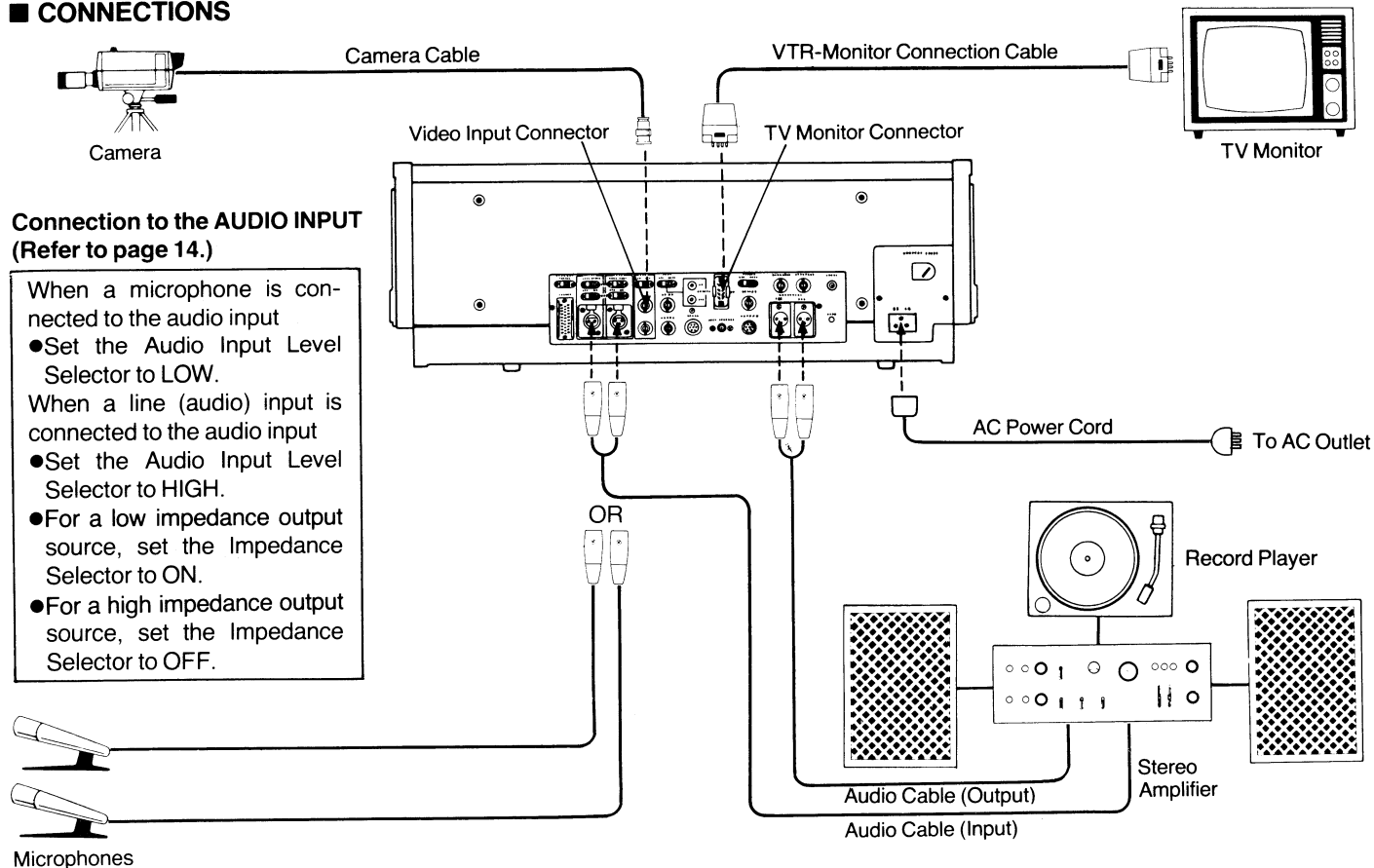
During insert editing, the original control track (from program "A") is preserved. A new control track is not recorded. Therefore it is most important that at the end of the inserted "B" program, there is a portion of "A" still remaining.



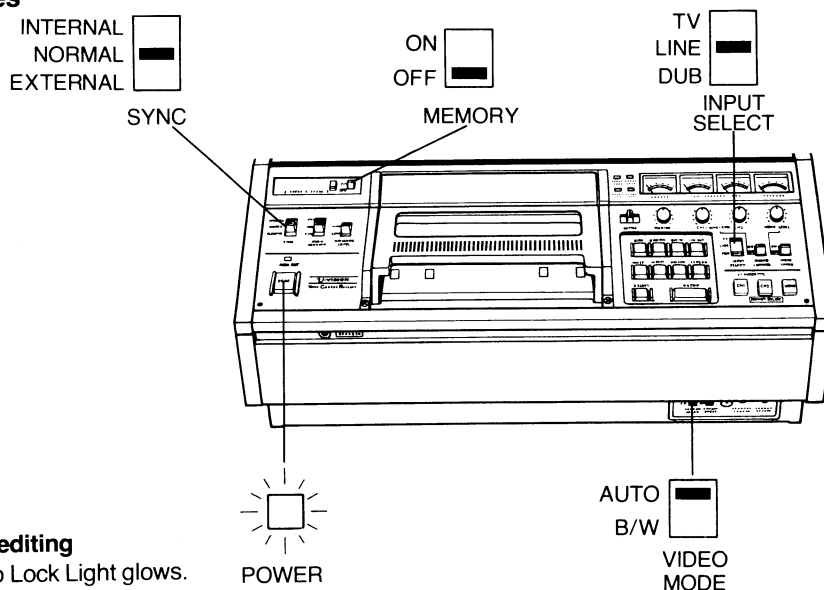
The figure shows insert editing for video and audio ch 2.

PROCEDURE FOR ELECTRONIC EDITING

■ CONNECTIONS



■ Setting of switches



●PECAUTION before editing

Be sure that the Servo Lock Light glows.

■ PREPARATIONS for editing

- (1) Insert the cassette tape.
Insert the cassette tape after making sure that the red button is not missing from the bottom. If this red button is missing, no recording or editing can be performed. The video cassette designed for still frame playback should be used in the editing system.
- (2) The new program to be added or inserted is on tape.
- (3) Adjust the video level.
- (4) Adjust the audio (CH1/CH2) level.
- (5) Press the Play Button for confirmation of the pre-recorded, original program on the tape.
- (6) Adjust the tracking control.

Note:

Never touch the tracking control after editing has started.

(continued on page 25.)

(continued from page 24.)

- (7) Adjust skew control.
- (8) Adjust horizontal phase.
- (9) Search for the editing point.

While watching the playback picture, press the Pause Button at the desired position for editing. A still picture will appear if the proper tape is used.

See page 8 for details.

- (10) Reset the counter.

Press the Tape Counter/Reset Button to reset to "0000".

This position is the beginning point for editing. For insert editing, press the Pause Button again and continue playing back. When the desired point for the end of the insert edit is reached, press the Pause Button again, and make a note of the number on the tape counter. This represents the end point for the insert edit.

- (11) Rewind the tape, and stop its movement by pressing the Stop Button at the position of the tape which is approximately 5 seconds before the desired edit point.

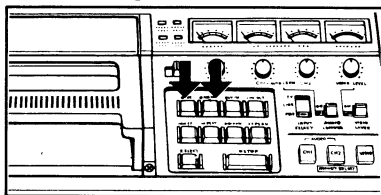
If assemble editing is desired

- (1) **Playback the tape.**

To playback the tape, press the Play Button.

If an E-E picture of the new program to be assemble edited is desired as the tape approaches the edit point, press the Record Button. The E-E picture and sound of the new program to be edited will appear on the TV monitor.

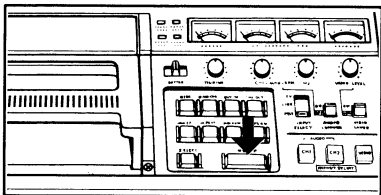
- (2) **Starting the edit.**



As the tape is being played back, when the Tape Counter display reaches "0000", the beginning of the portion to be edited has been reached. Press both the Record Button and the Edit Button at the same time.

The assemble edit will start, and the picture and sound of the new program being edited will appear on the TV monitor.

- (3) **Stopping assemble editing.**



Press the Stop Button to stop the assemble edit, when desired.

Note:

At the end of assemble editing, if there is a portion of the original program remaining on the tape, the transition back to the previously recorded program will not be smooth. If a smooth transition is desired, insert editing should be used.

If insert editing is desired

- (1) **Selection of insert signal.**

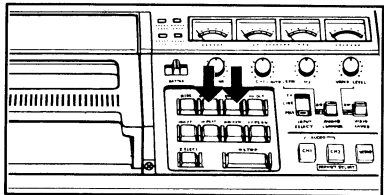
For insert editing, press the appropriate Insert Selector Buttons "ON" for selection of any combination of video, audio CH1 and/or CH2 editing. See page 11.

- (2) **Playback the tape.**

To play back the tape, press the Play Button.

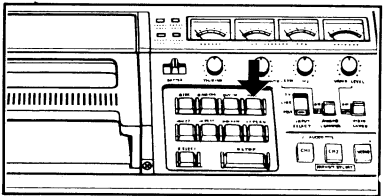
If an E-E picture of the new program to be insert edited is desired as the tape approaches the edit point, press the Cut In Button. The E-E picture and sound of the new program to be edited will appear on the TV monitor, without actual editing.

- (3) **Beginning of insert editing (CUT IN).**



When the tape reaches the editing position previously selected (counter indicates "0000"), press the Edit Button and the Cut In Button at the same time. The picture and sound to be edited will appear on the TV monitor, and the insert edit will begin.

- (4) **End of insert editing (CUT OUT).**



When the counter indicates the end of the insert edit, press the Cut Out Button. The picture and sound being edited will disappear from the TV monitor, and then the picture will return to the previously recorded program.

At this point, the insert edit is finished.

CAUTIONS:

- To avoid an incomplete ending, do not press the Stop Button at the end of the insert editing without first pressing the Cut Out Button.
- Do not adjust the Tracking Control during insert editing. The Tracking Control has been adjusted during preparation for editing.

EDITING WITH OPTIONAL EDITING CONTROLLER

By using the optional editing controller with the video cassette recorder the additional editing features are available, allowing more convenient and accurate edits to be performed.

Video cassettes of the tape designed for still frame playback must be used in the editing system.

Typical Editing Systems Using Editing Controller AU-A70

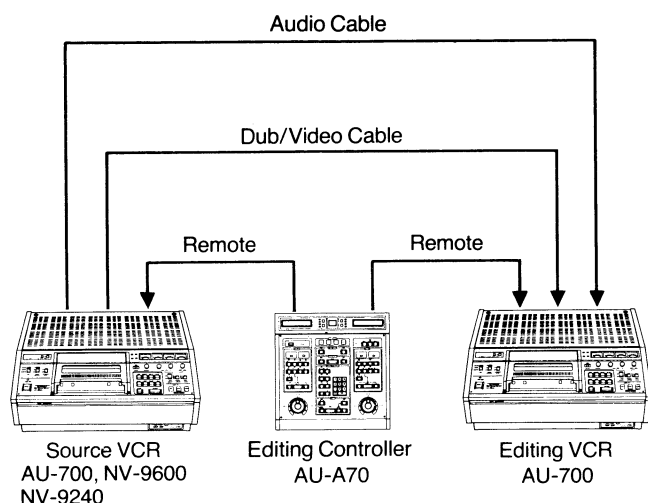
The built-in time code generator of the Editing Controller AU-A70 permits programmable editing with the time code signal, and can operate two source VCRs simultaneously when desired. For detailed instructions, refer to Operating Instructions of AU-A70.

1) With one source VCR

In this case, connect the remote cable of the source VCR to the VTR 1 terminal of the Editing Controller AU-A70.

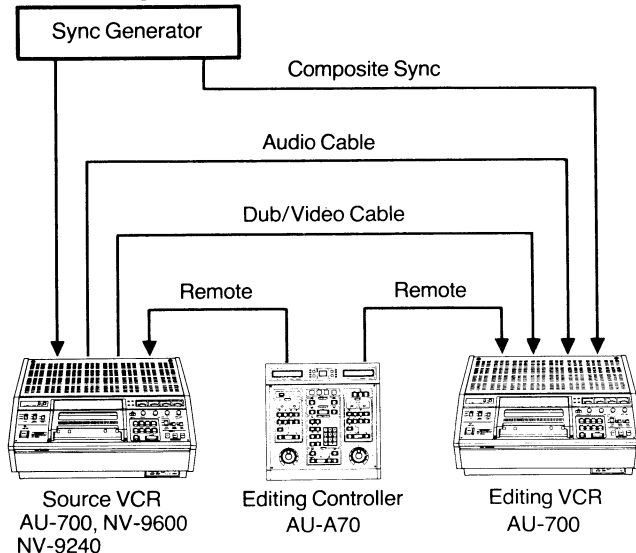
1. Basic editing system

For Setting of Switches, refer to page 28.



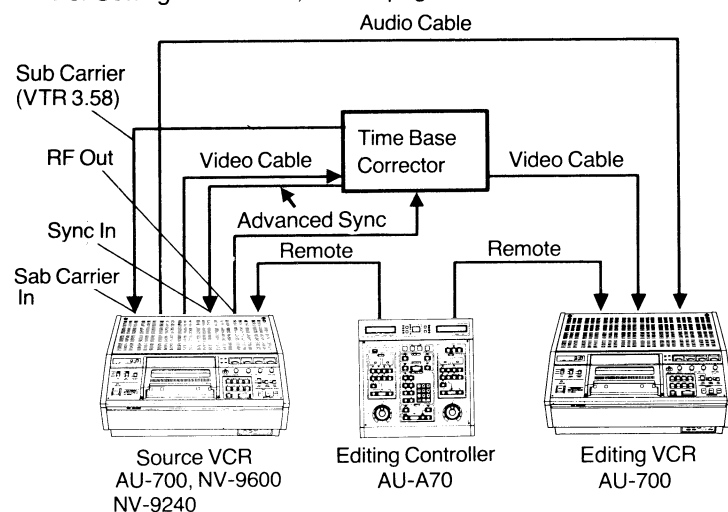
2. With external sync

For Setting of Switches, refer to page 28.



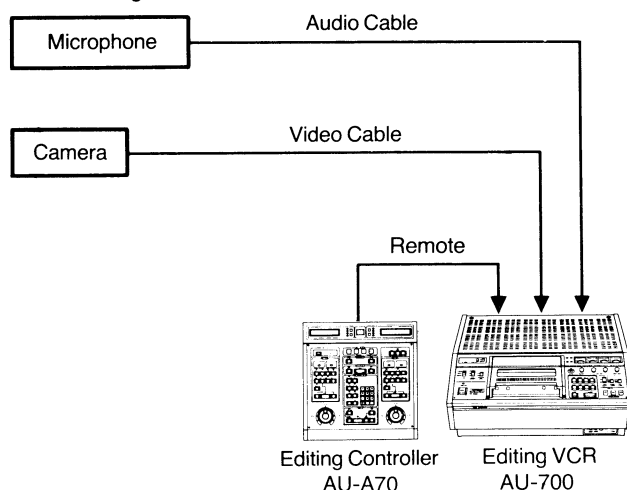
3. With time-base corrector

For Setting of Switches, refer to page 28.



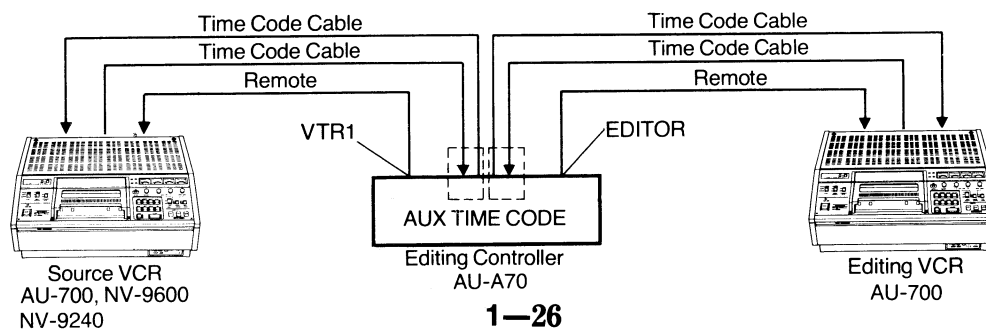
4. Remote real time

For Setting of Switches, refer to page 18.



Note:

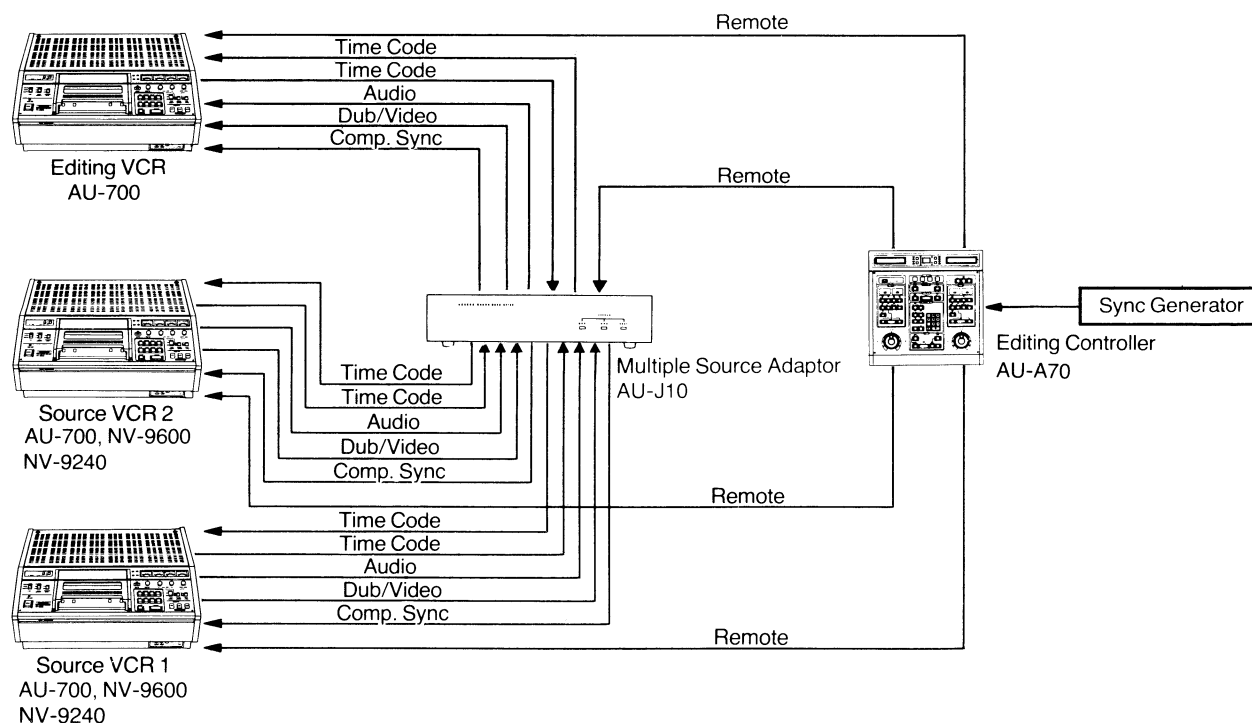
Make connection in the following way when you record the time code signal from AU-A70 onto both the tape of the source machine and of the editor machine at the same time.



2) With two source VCRs

(In this case, use the Multiple Source Adaptor AU-J10.)

Typical editing system is described as follows;



Notes:

- Depending on the connected equipment, use the BNC type or the dubbing connector for the cable for the video signal.
- When the AU-700 is connected to the Editing Controller AU-A70, set the Controller Selector Switch to the "A70/A960" position.

Typical Editing System Using Editing Controller NV-A960/NV-A950

The NV-A960/NV-A950 Editing Controller permits the same systems as that of using the Editing Controller, AU-A70, section "With one source VCR" (described on page 26.)

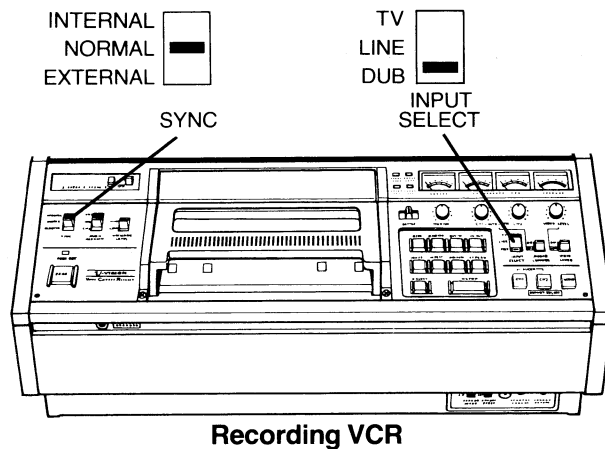
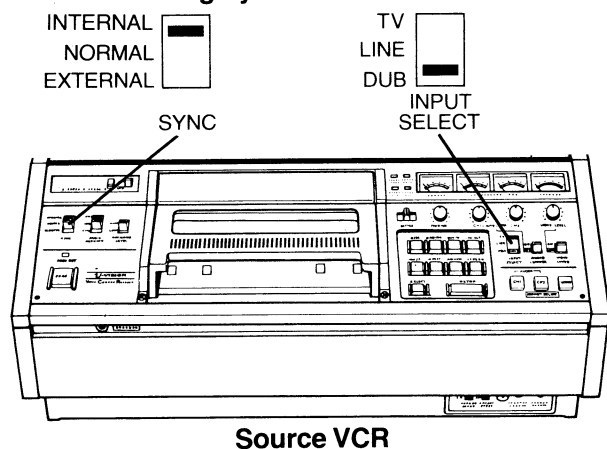
Refer to the Operating Instructions of the Editing Controller NV-A960/NV-A950 for detailed instructions.

Notes:

- When the AU-700 is connected to the NV-A960 Editing Controller, set the Controller Selector Switch to the "A70/A960" position.
- When the AU-700 is connected to the NV-A950 Editing Controller, set the Controller Selector Switch to the "A950" position.

Setting of Switches

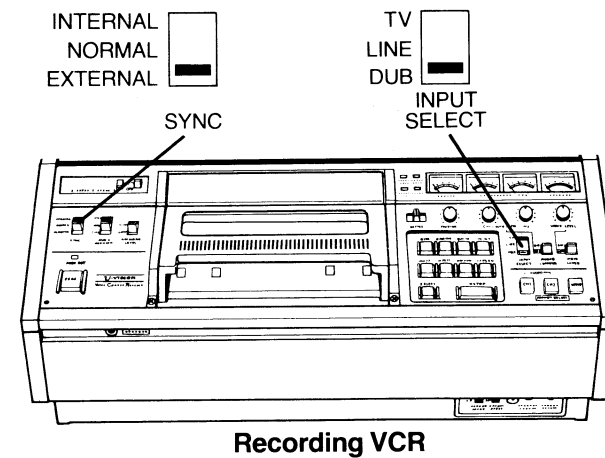
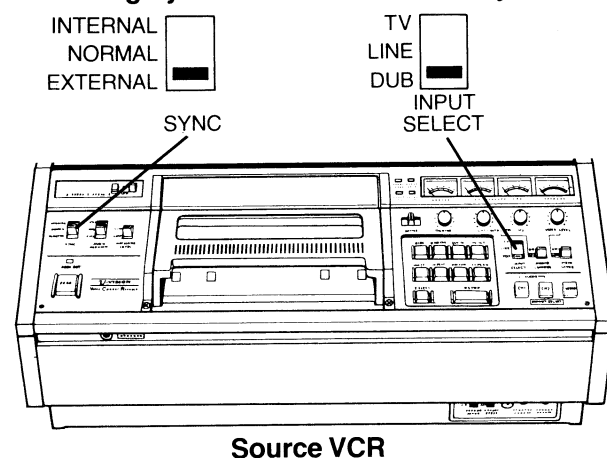
1. Basic Editing System



Notes:

- With the Input Signal Selector for source VCR set to "DUB", the color APC and noise eliminator circuits do not function. This is desired for the reasons explained in Dubbing System 2. Note (page 22).
- With the Sync Mode Selector set to "INTERNAL", the source VCR will be locked to its internal 60 Hz oscillator (derived from an internal crystal source).

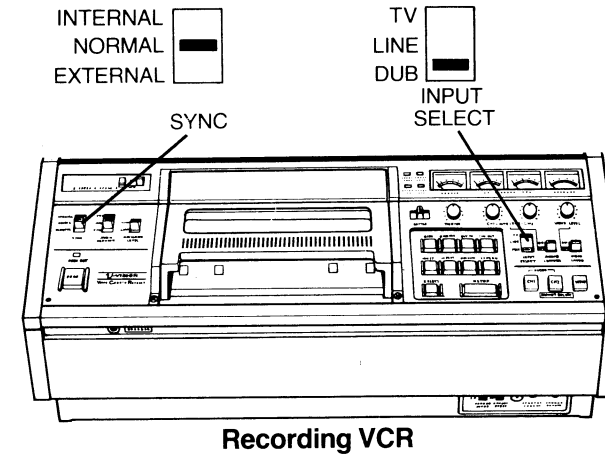
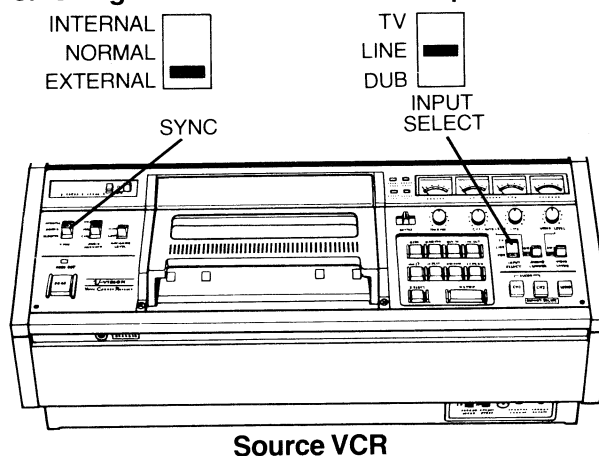
2. Editing System locked to External Sync Source



Notes:

- The Input Signal Selector for source VCR should be set to "DUB" for the reasons described in Dubbing System 2. Note (page 22).
- Setting the Sync Mode Selector to "EXTERNAL", allows the externally connected composite sync signal to drive the source VCR.

3. Using a Time Base Corrector as part of an Editing System

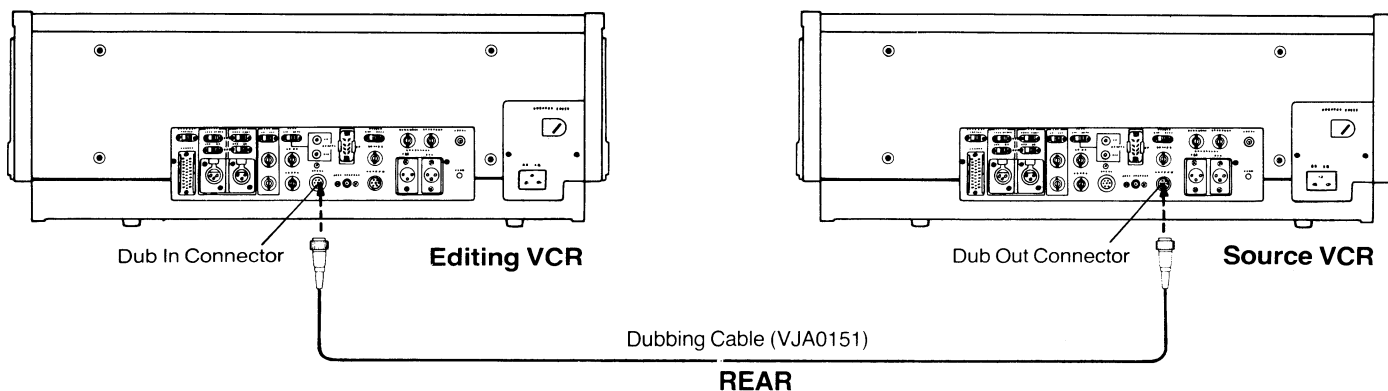


Note:

The Input Signal Selector for source VCR must be set to "LINE" (APC and noise eliminator circuits function), because the subcarrier signal developed by the time base corrector and feed back to the source VCR creates interleaving.

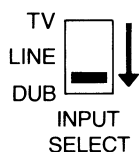
■ If the Dubbing cable (7-pin) is being used for editing, connect the Dubbing Cable as follows:

If the Dubbing Cable (7-pin) is being used for editing, ensure that the editing system is VTR To VTR editing system. (but, when the time base corrector is connected, the dubbing cable cannot be used. Use the BNC-type connector cable.)

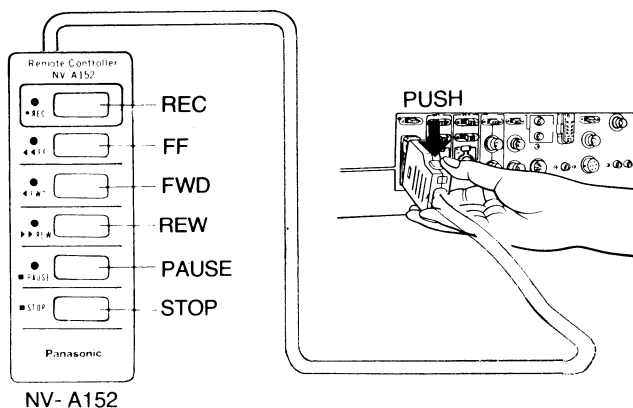


● Switch Setting

Except for the Input Signal Selector, the setting for the switches on both VCRs is the same as that shown on page 28. For the source and editing VCRs, both the Input Signal Selectors should be set to the "DUB" position.



USING THE REMOTE CONTROL



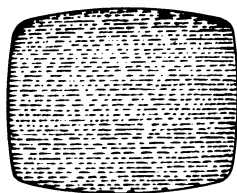
- If the optional remote control (NV-A152) is connected to the Remote Control Connector, Record, Forward, Fast Forward, Rewind, Pause and Stop modes can be performed from a distance.
 - The controls on the VCR may still be used even when the optional remote control (NV-A152) is connected.
 - There are two models of optional remote control units which can be used with this VCR; model NV-A152 (designed primarily for use with NV-9000 series VCR) and NV-A150 (designed primarily for use with the older NV-2000 series VCR).
- It is recommended that the optional remote control, model NV-A152 for the NV-9000 series 3/4" VCR's be used. For detailed information regarding operation of the remote control unit, refer to the operating instructions of the remote control unit.

FUNCTION CHART WHEN COMBINING THE REMOTE CONTROLS AND 3/4" VCR's

Remote Control 3/4" VCR	If used with NV-A152	If used with NV-A150
NV-9000 series	Full function (Recommended) Combination	No Fast Forward function
NV-2000 series	No Fast Forward function No Pause function	No Fast Forward function (Recommended) Combination

- Note:**
The remote control units have the following functions;
- (A) NV-A152: Record, Forward, Fast Forward, Rewind, Pause, Stop.
 - (B) NV-A150: Record, Play (Forward), Rewind, Stop, Audio Dubbing.

HEAD CLEANING



- When a grainy image is produced during playback, as shown in the illustration, it is usually caused by a dirty video head. Clean the video head by using optional cleaning tape (NV-P20).
1. Load the optional cleaning tape (NV-P20) into the Cassette Compartment and press Play Button as if to play back the tape.
 2. Allow the cleaning tape to run for 15 to 30 seconds, and press Eject Button.
 3. Load and play back a pre-recorded tape known to be of good quality.
- If no improvement is noted, refer unit to qualified service personnel.
- CAUTION:**
Prolonged usage of the cleaning tape will shorten video head life drastically.
Do not attempt to record or play back by using this cleaning tape.

CONDITIONS WHICH ARE APT TO BE MISTAKEN FOR A MALFUNCTION

Condition	Main cause and remedy
If there is no power to the unit . . .	●Is the AC power cord connected?
If no operation starts when operation buttons are pressed.	●Is the Auto OFF Light on? See page 2.
If tape can't be rewound . . .	●Is the tape already completely rewound?
If audio levels are improper . . .	●Are the Audio Input Level/Impedance Selector switch in the correct position? See page 14.
If the playback image is grainy . . .	●This is usually caused by a dirty video head. Clean the video head by using cleaning tape, Panasonic model NV-P20. See Head Cleaning instructions, page 30.
If the playback image is noisy	●Turn the Tracking Control. See page 13.
If there is no color image during playback . . .	●Is the Video Mode Switch set to the "AUTO"?
If the upper part of the playback image is slightly distorted . . .	●Slowly move the Skew Control to left or right. See page 12.
If the playback image is completely distorted . . .	●If the playback image is periodically completely distorted, check the following items: 1. Are radio interference or changes of power voltage occurring during recording? 2. Is horizontal hold control of TV monitor set correctly? 3. Is the cassette tape defective?

MECHANICAL DESCRIPTION

General Mechanical Description

The mechanical transport accepts the cassette tape, lowers it into the unit, and provides for rapid shuttle of the tape forward and backward (Fast Forward and Rewind) as well as Play in five speeds (1/20, 1/5, normal, X2, and X5) in both directions. Record is mechanically the same as normal Play forward.

The tape is extracted from the cassette in all modes for tape time display, and is completely returned for Eject, which raises the cassette out of the unit.

The cassette and tape transport mechanism of this unit is less mechanical than in previous models, due to the use of six solenoids and six motors. These devices are controlled by the System Control, VEP0696.

The mechanical sections may be divided into inter-related sections.

Cassette elevator: The cassette compartment is raised and lowered by a reversible DC motor which drives two identical rack and pinion gear assemblies.

Loading mechanism: The tape is withdrawn from the cassette by a threading arm, which is gear driven in conjunction with the loading ring by a common reversible DC motor. The loading mechanism has three states: Unloaded, where the tape is completely within the cassette; Subloaded, where the tape is taken out of the cassette, past the CTL/Audio head, but not around the video head cylinder or across the capstan; and Loaded, where the tape is wrapped around the head cylinder and past the capstan. The Subloaded configuration is used for the Fast Forward (FF) and Rewind (REW) modes, while the Loaded configuration is used for the Play and Record modes. The tape must be unloaded for Eject.

After the tape is withdrawn by the Threading Arm, posts on the Loading Ring guide the tape around the head cylinder for loading.

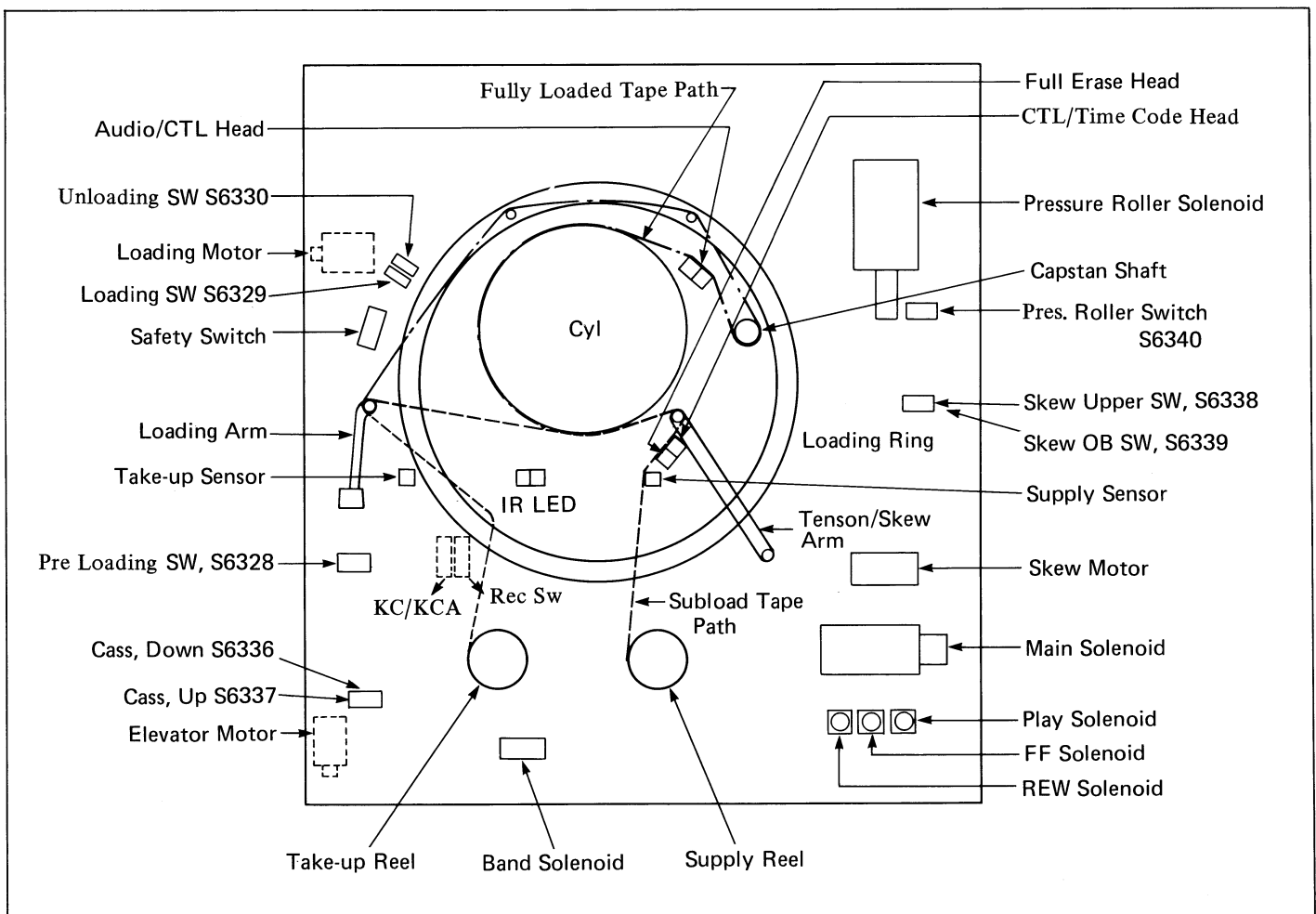


Fig. 1

The angle of tape travel changes from the Subloaded mode to the loaded mode, due to the difference in path length versus fixed turnable height. To compensate for this, the angle of the Loading Arm is changed as the loading process continues from Subload to (fully) Load. Additionally, a moveable guide post is removed from the tape path when loading is almost complete, by the rotation of the Loading Ring.

Mode Selection Mechanism: Three mode select solenoids pick one of three sliding bars to be pulled by the Main Solenoid to effect the Play, Forward or Reverse mode. The sliding bar positions one of two idlers to allow the Reel Drive motor to turn either the Takeup or Supply turntable. This bar also causes the main brake on the Takeup turntable to be released.

The Forward mode is used for Fast Forward, the Play mode is used for forward Play at any speed, and Reverse is used for both Rewind and reverse Play. In reverse Play, the normal Supply turntable functions as the takeup, and vice versa.

Capstan/Pressure Roller Mechanism: The capstan sets the tape speed during Play and Record. The Servo, reacting to speed commands from the System Control circuit, causes the capstan drive to make the capstan go the proper speed and direction. Since the capstan is direct drive, no gears or belts are involved for change of either speed or direction.

The tape is held against the capstan shaft by the Pinch or Pressure roller.

This Pressure roller is mounted on the loading ring, and the loading process brings it into proper position. The Pressure roller solenoid pinches the tape between the capstan and roller, and simultaneously releases the Supply turntable brake. This solenoid is also energized during Fast Forward and Rewind for this Supply side brake release.

Video Head Cylinder: The video head cylinder is a direct drive unit, and is completely controlled by the Servo. Therefore, no mechanical parts affect its operation.

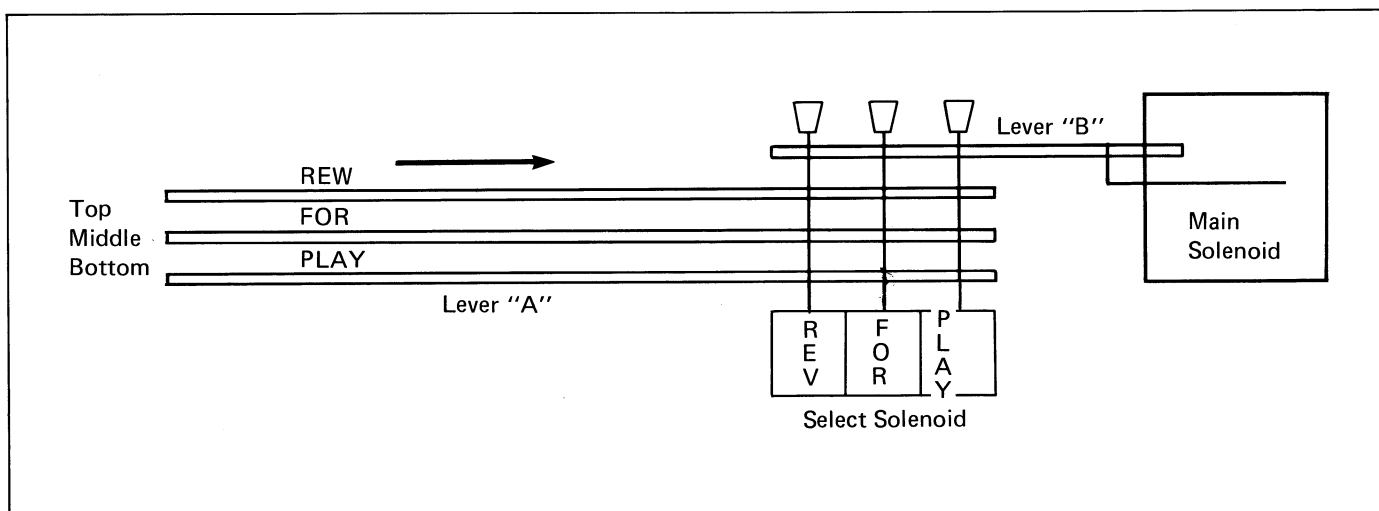


Fig. 2

Tape Tension Mechanism: A conventional arm, post and brake band arrangement is used to control normal tape "back tension". The tension arm also withdraws tape from the cassette during the loading process, and is driven by the loading gears. After Subloading is complete, it is independent, and provides subtle tightening and loosening of the brake band which wraps around the Supply turntable.

This increases or decreases the tension of the tape around the head cylinder prior to being pulled by the capstan.

In the reverse play mode, when the normal Takeup reel functions as the supply, a similar brake band arrangement is utilized on the Takeup side. A small solenoid enables this brake band and arm only during reverse play.

Detailed Mechanical Description

CASSETTE DETECTION

When the tape is placed fully into the cassette compartment, S6333 and S6334 (Cassette Position) turn on. If no cassette is inserted, S6335 (No Cassette) is off. If a cassette is partially inserted, the elevator is inhibited because the No Cassette switch is on, but the Cassette Position is not (see Fig. 3).

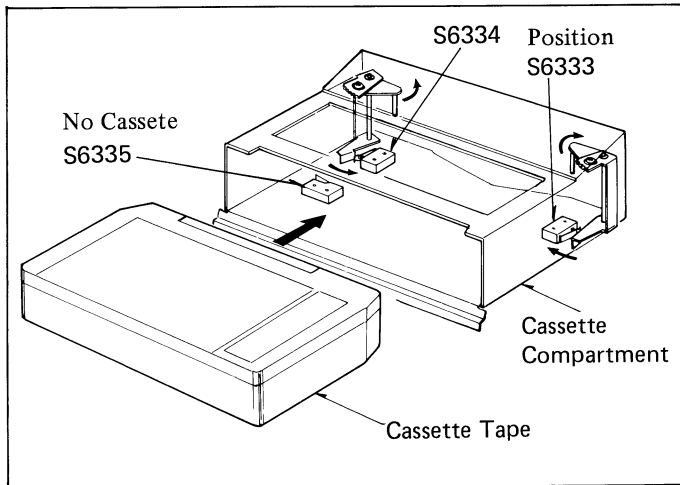


Fig. 3

CASSETTE ELEVATOR

The activation of any mode causes the elevator motor to turn counterclockwise, and all of the elevator gears turn (see Elevator Sequence and Figure 4). The cassette compartment is thus lowered.

Elevator Sequence

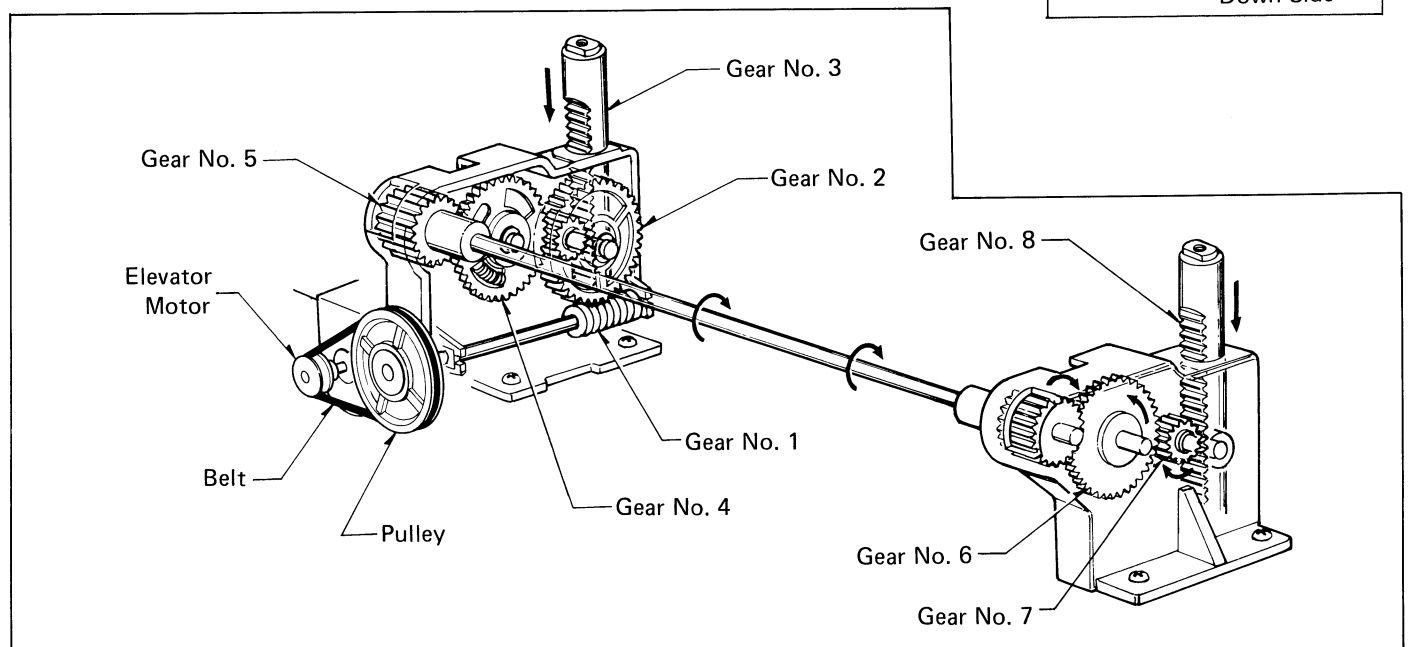
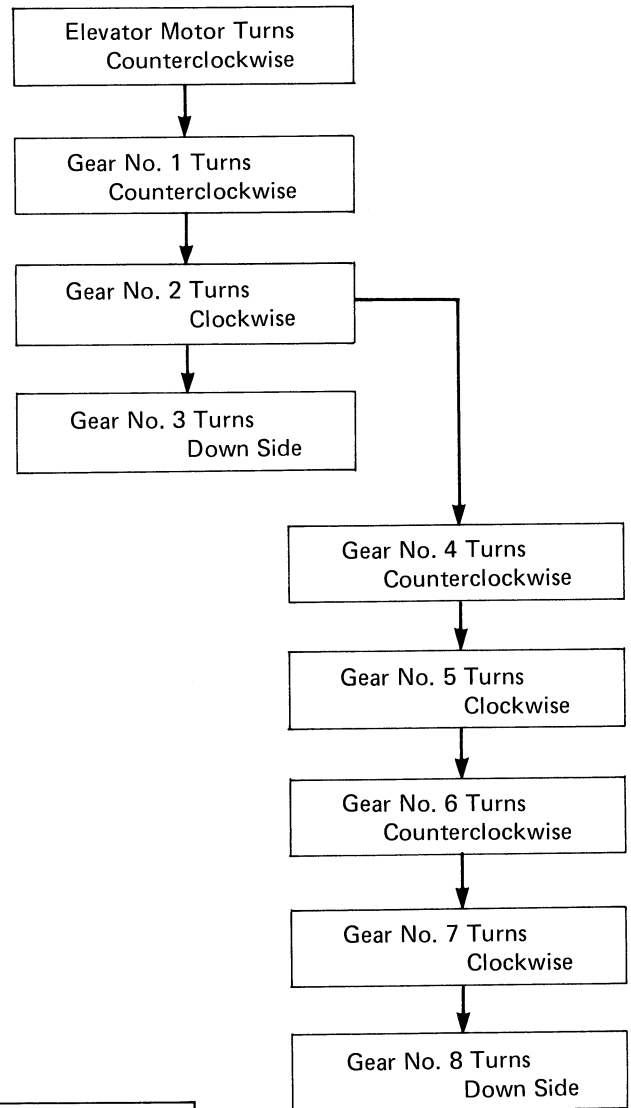


Fig. 4 Elevator Mechanism

Gear 4 has a pin which protrudes from one side (Figure 4). When the cassette compartment is completely lowered, this pin (A) pushes the microswitch actuator (S6336) and the elevator motor is stopped (see Fig. 5).

If the Eject mode is initiated, the process is reversed. The motor turns clockwise, and Gear 3 and 8 raise. Pin (A) operates S6337 to stop the motor at the fully raised position. Both switches have adjustments to set correct position, and the motor drive comes from the System Control circuit, actuated by the logic. Note that if no cassette is in place, the elevator will still raise and lower for cassette compartment protection and appearance.

When a cassette is in place, and the elevator is completely down, the loading process begins.

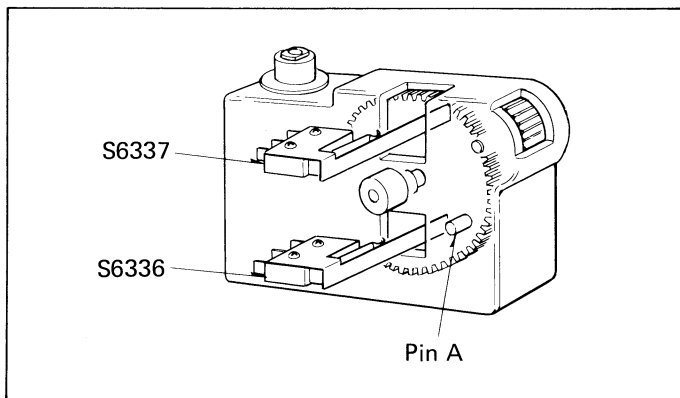
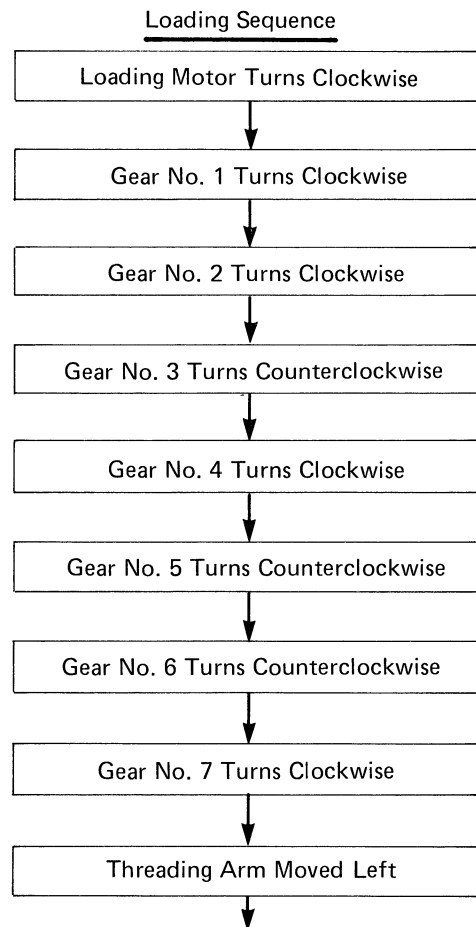


Fig. 5 Elevator Limits



LOADING

The loading process begins when the loading motor turns clockwise. Then all of the gears turn (see Loading Sequence and Figure 6).

Depending upon the mode selected, loading will either stop at the Subloaded position or at the Loaded position.

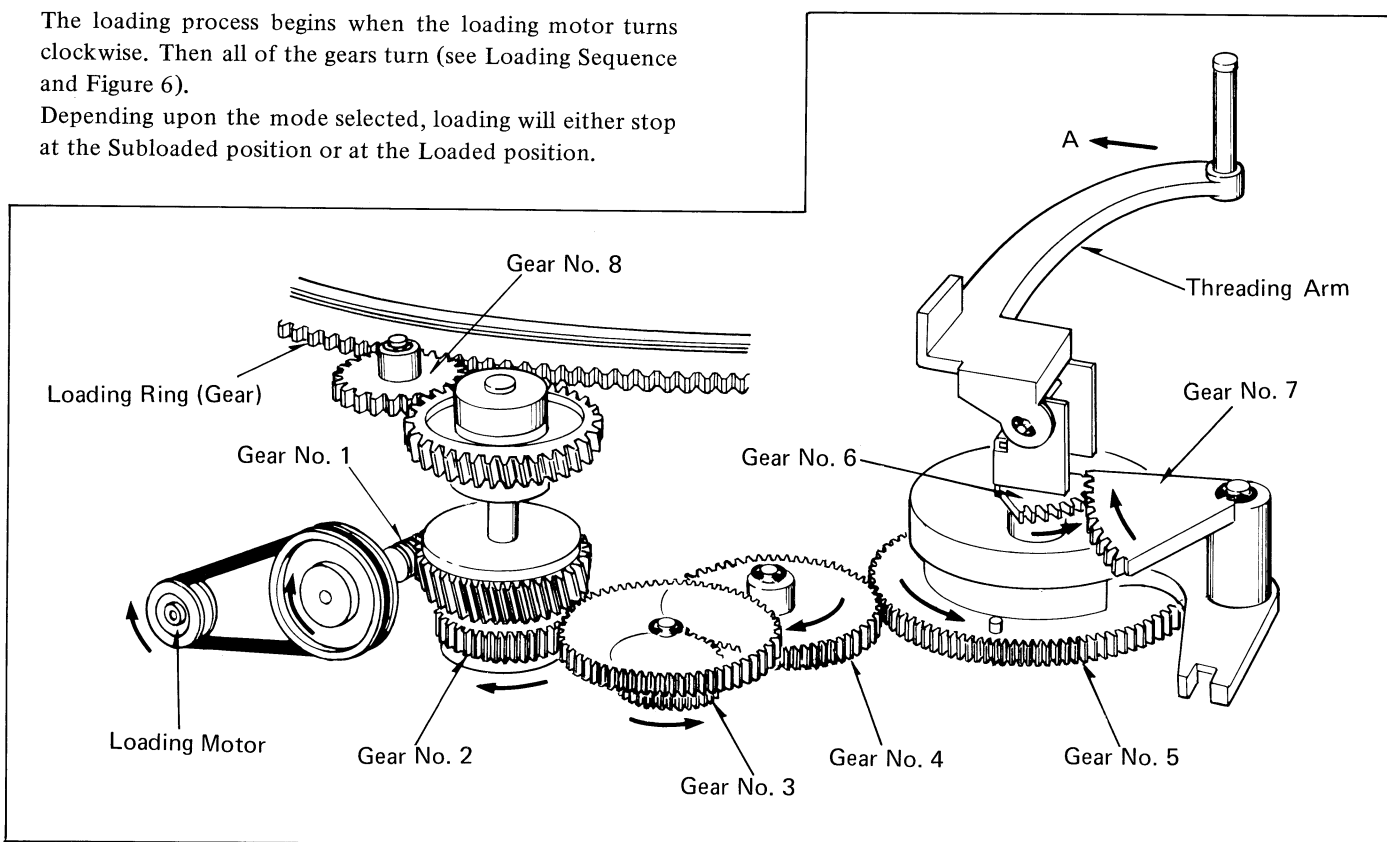


Fig. 6

In Figure 6, note that the threading arm and Gear 6 are one piece which is not attached to Gear 5. Gear 5 has a pin (A) which fits a fork or slot in the bottom of the Gear 7 piece. This means that Gear 7 will only move about 90°, even if Gear 5 continues to rotate (See Fig. 8).

This is necessary because the position of the Threading arm is the same for the subloaded and the fully loaded modes, and to accomplish full loading, the gear train must continue turning.

When pin A causes Gear 7 to rotate, not only the Threading Arm on Gear 6 moves, but Lever B moves Lever C. Lever C goes across the transport to move the Skew or Tape Tension Arm (see Fig. 8 and 9).

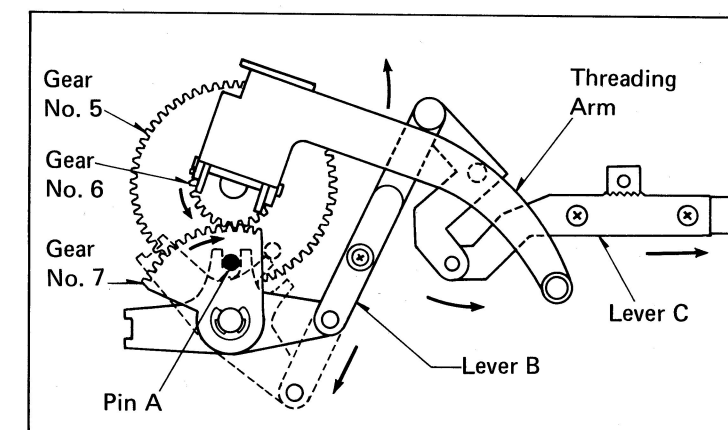
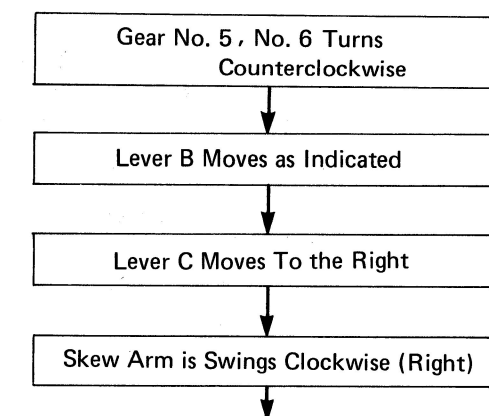


Fig. 8

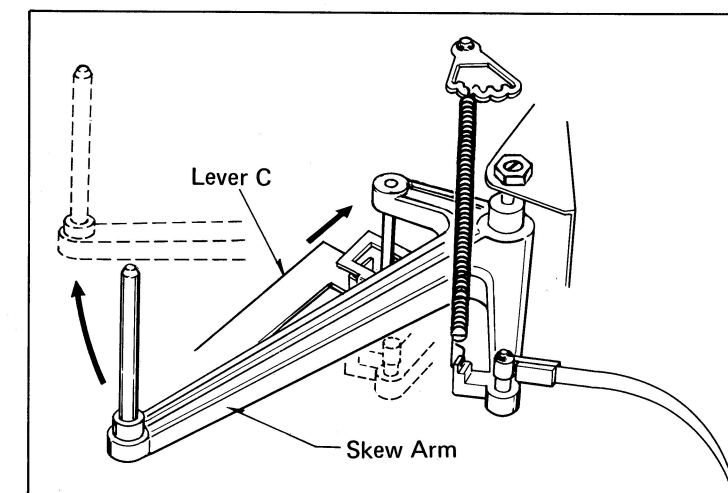


Fig. 9

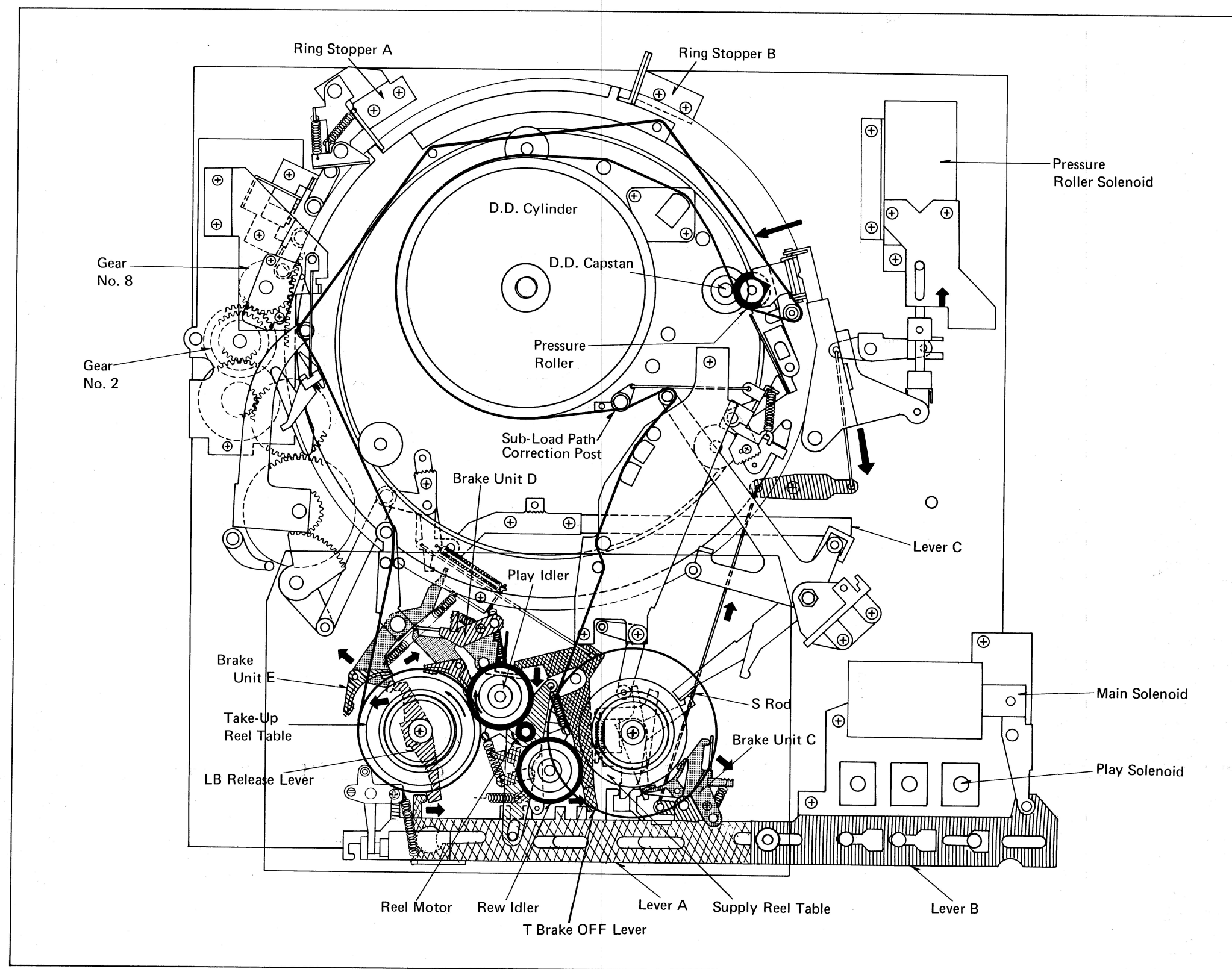
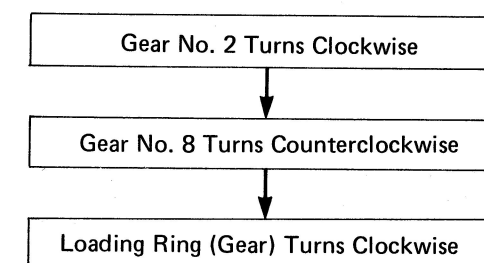


Fig. 7 Play Mode

Three switches are associated with the loading/unloading process: S6328, Preunloading Switch; S6329, Loading Switch; and S6330, Unloading Switch (See Fig. 1). S6328 is operated at the completion of unloading, and signals to stop the motor and raise the elevator. S6329 and S6330 are operated by grooves in the outer edge of the Loading Ring. If the mode selected requires only Subloading, the loading motor will run until S6329, the loading switch, is actuated. This brings the tape out of the cassette and the loading arm and the skew or tension arm both into the correct position.

If the mode selected requires complete loading, the loading motor will run until S6330, the unloading switch, is activated. In this case, the upper and lower rings will have rotated to bring the tape completely around to the capstan. The top of Gear 5 is a cam which pushes a rod that extends from the base of the rear of the Threading arm.

This cam rotates with continued loading, and the angle of the post on the Threading arm is changed, depending upon subload or full load.

The continued rotation of the loading ring also moves the upper and lower rings, and the guide posts attached.

A boss or protrusion on the loading ring pushes the end of the upper and lower rings. The leading edges of these rings are caught and held by Ring stopper brackets, which are adjustable and set the ring position. They are kept tight by pressure from the boss (See Fig. 10).

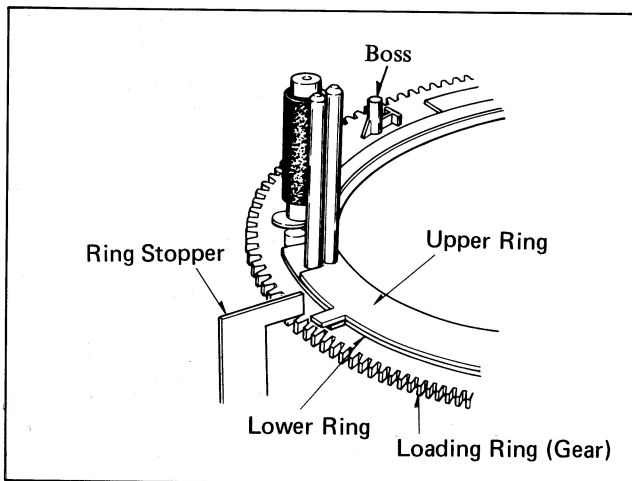
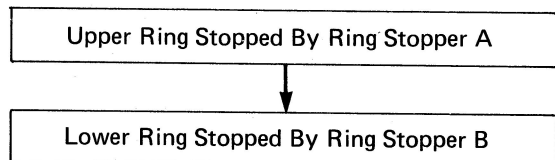


Fig. 10



This boss also has a post-like part which actuates two levers. One lever moves a rod which removes the Subload path correction post, and the second positions the Pressure roller close to (but not touching) the Capstan. These two functions occur just as full loading is being completed.

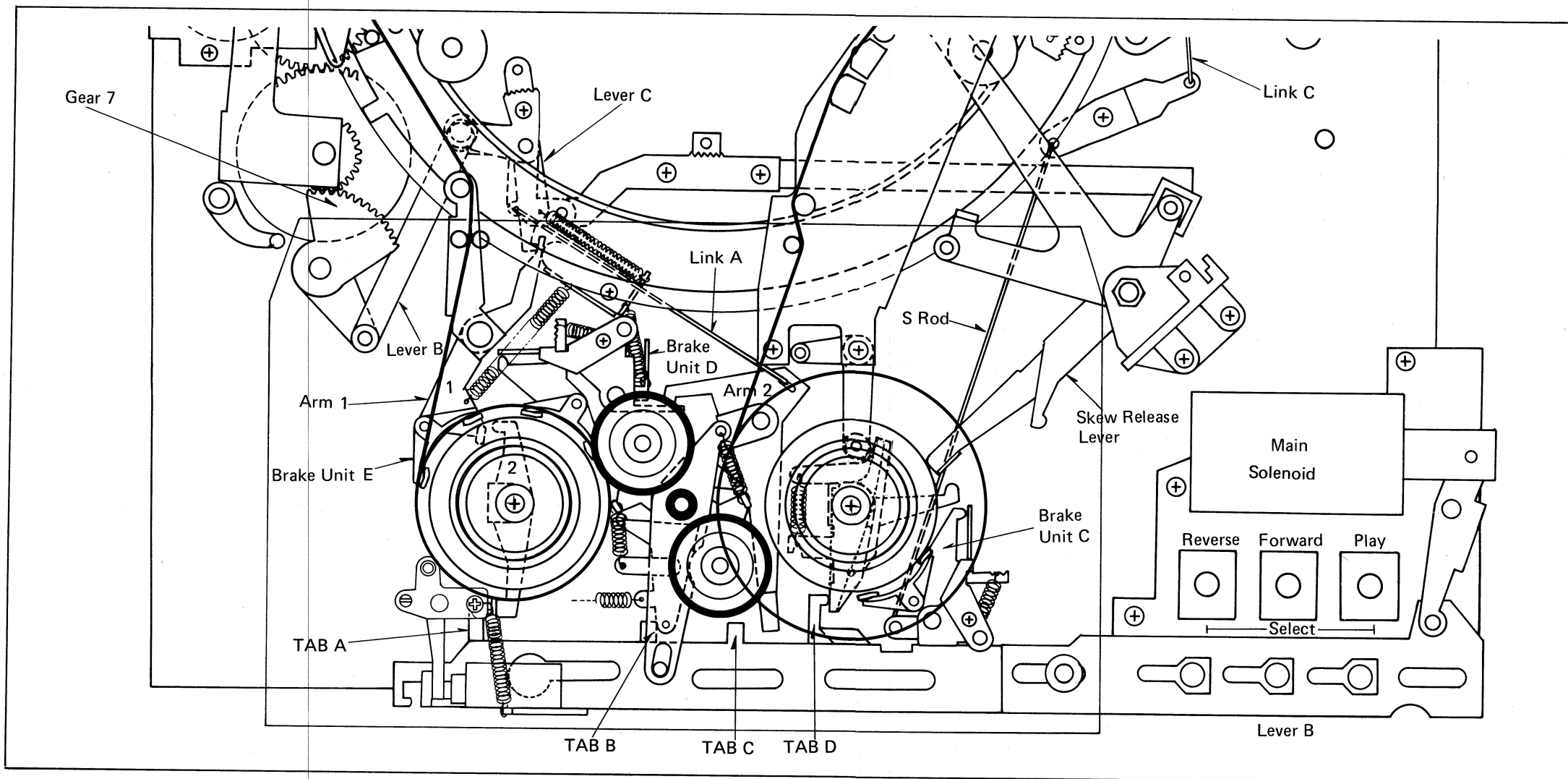


Fig. 11 Sub-Load (No Mode Select)

When the Loading process begins, the movement of gear 7 and Levers B and C not only move the Skew or tension arm, but also operate through Arm 1 to release Brake Unit E and through Link A to rotate Arm 2, which limits the travel of Brake Unit D (See Fig. 8 and Fig. 11).

REWIND MECHANISM

When the Rewind mode is selected, the Reverse select solenoid and the Main solenoid are energized after Subloading. The Main Solenoid pulls Lever B which moves the top Lever A so that the tabs, or protrusions, push the same brake release as the loading process. Tab A pushes the LB release, which holds Arm 1 and Brake unit E off.

Tab C pushes Arm 2, which is held by Link A.

This would appear to be unnecessary, except at the completion of a mode and the start of eject, when the loading mechanism brake release is removed, but brake D and E release is still required until unloading is completed.

In addition, the Reverse Spring Lever pulls the Rewind idler into contact with the Reel Motor and the Supply reel table so the supply side may be driven.

Finally, the Pressure roller Solenoid operates to pull the S rod which releases brake unit C; the reel motor is energized, and Rewind begins (See Fig. 12).

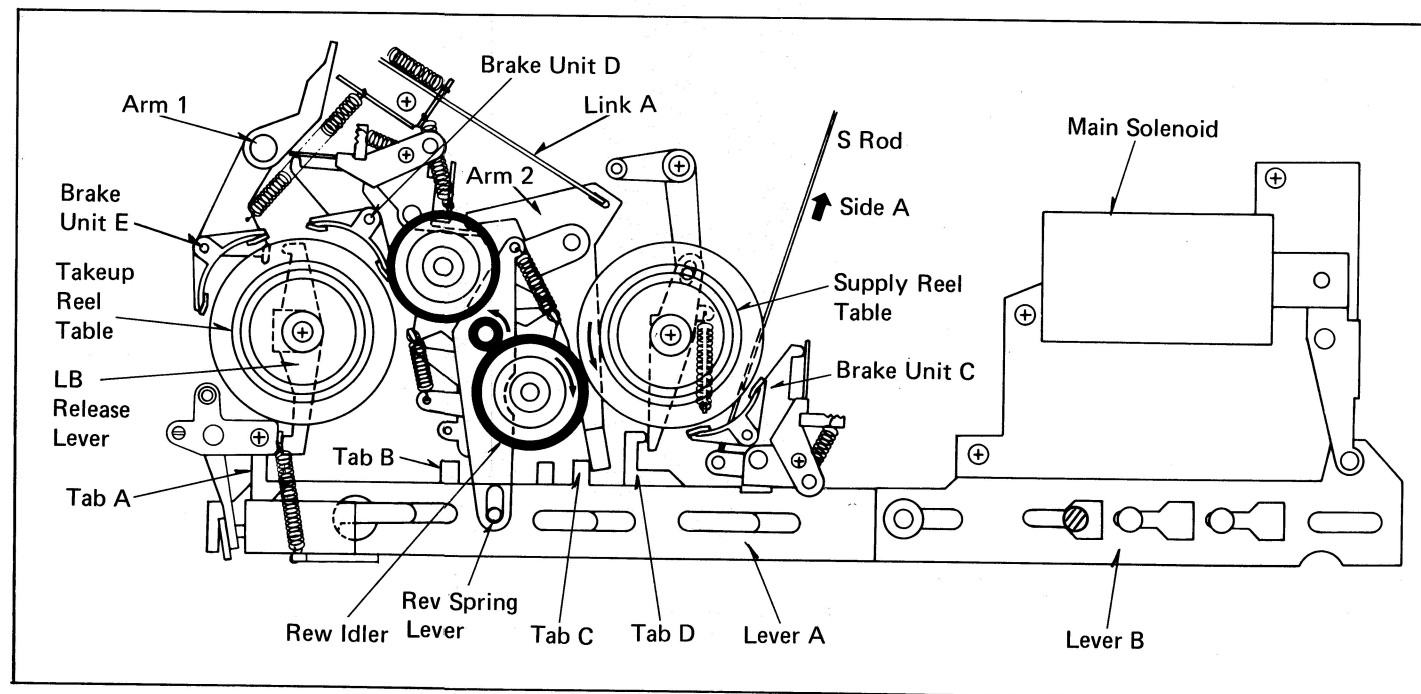


Fig. 12 Rewind Mode

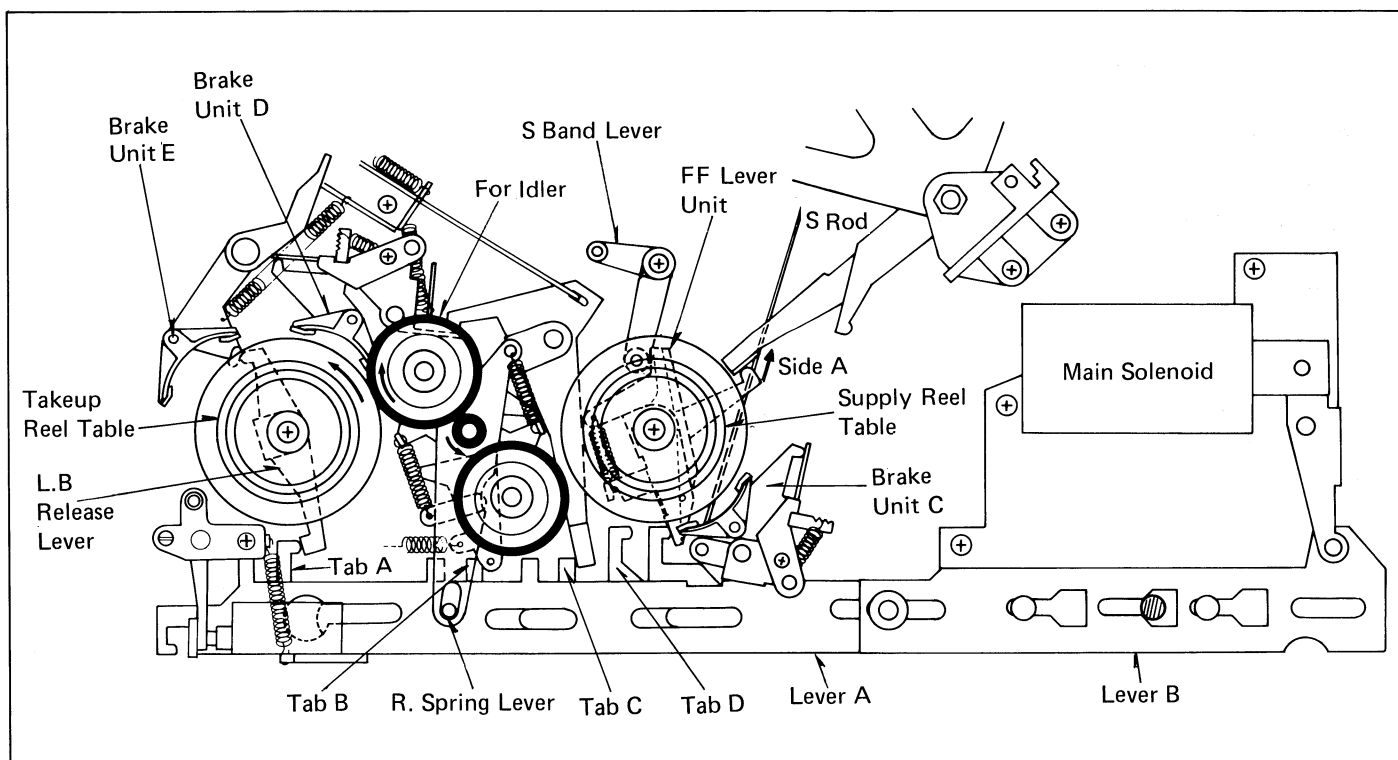


Fig. 13 FAST FORWARD MODE

FAST FORWARD MECHANISM

Fast Forward is very similar to Rewind except the Forward Select solenoid and the Main solenoid are energized after Subloading. The second level Lever A is now pulled by Lever B, which acts exactly the same way at Tab A and Tab C as did the top piece, but the Reverse Spring Lever does not move. Instead, Tab B pushes the Fast Forward Idler into contact with the Reel Motor and the Takeup reel table. Tab D, which is not present on the upper Lever A, moves the FF lever unit beneath the Supply reel table to apply some spring tension to the S band lever. This provides Fast Forward back tension. The Pressure roller solenoid again causes the release of Brake Unit C through Rod S (See Fig. 13).

PLAY MECHANISM

When the play mode is selected, the same loading process brake release which operated for Rewind and Fast Forward releases Brake units D and E. The Play select solenoid and the Main solenoid move the third level of Lever A, and Tabs A, B, C and D all to the right. Tabs A and C operate as they did in Rewind to assure brake release.

Tab B operates as in Fast Forward to place the Forward idler in contact with the Takeup reel table and the Reel Motor.

Tab D pushes on the P. Driving lever, located below the FF Lever Unit, to hold the S band lever and release the Skew Arm so that the skew band will control tape tension (See Fig. 14).

When the tape is fully loaded, the operation of the Pressure roller solenoid will pinch the tape to the capstan and also release Brake unit C.

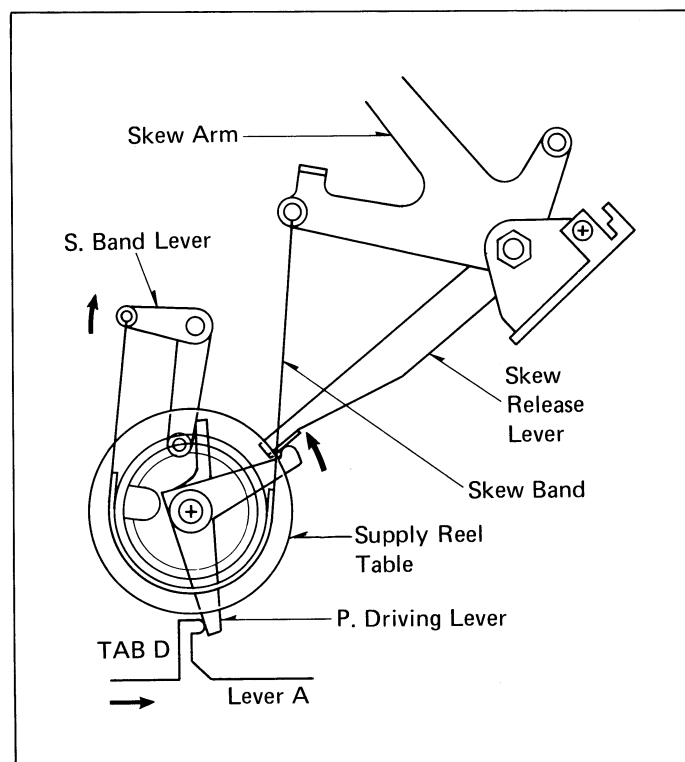


Fig. 14

PLAY REVERSE

When play backward is required (by command from the remote control), a combination of the above modes is used. Tape is fully loaded, as in Play, but the Reverse select, not the Play select solenoid, is used to move the top Lever A. This causes the release of the skew band tension control, because there is no Tab D on the top Lever A. The Reverse Spring Lever pulls the Rewind idler into contact so the Supply reel table can be driven for takeup.

Lastly, the Takeup reel table must function as the supply, so a tension brake band and tension arm arrangement, which is not used in other modes, is used. A small solenoid moves the "fixed" the end of the brake band through a lever so it makes contact with the Takeup reel table (See Fig. 15).

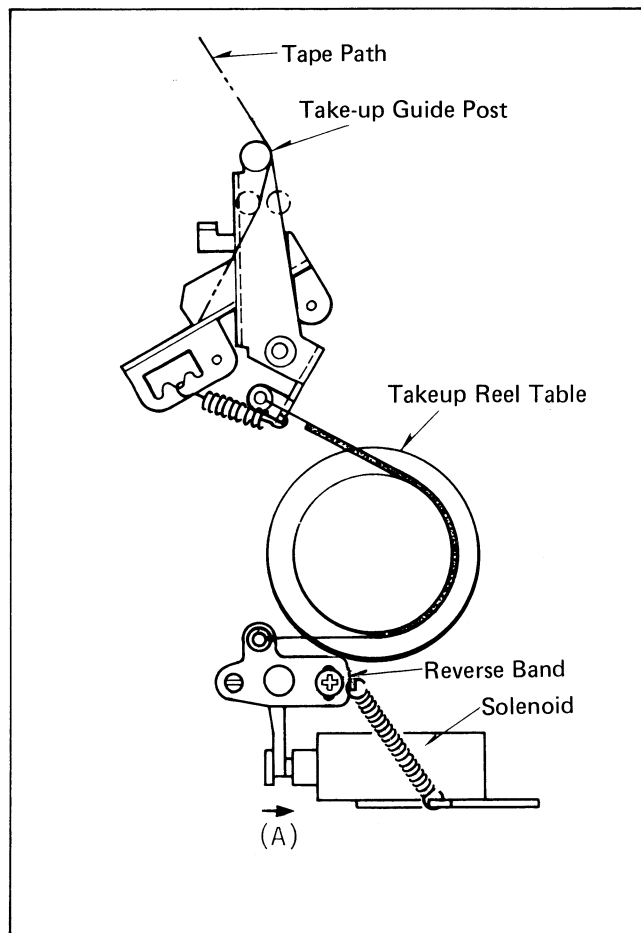


Fig. 15

MODE SELECT MECHANISM

When the main solenoid is energized, the level of Lever "A" selected by the Select Solenoid will move in the direction shown (See Fig. 16).

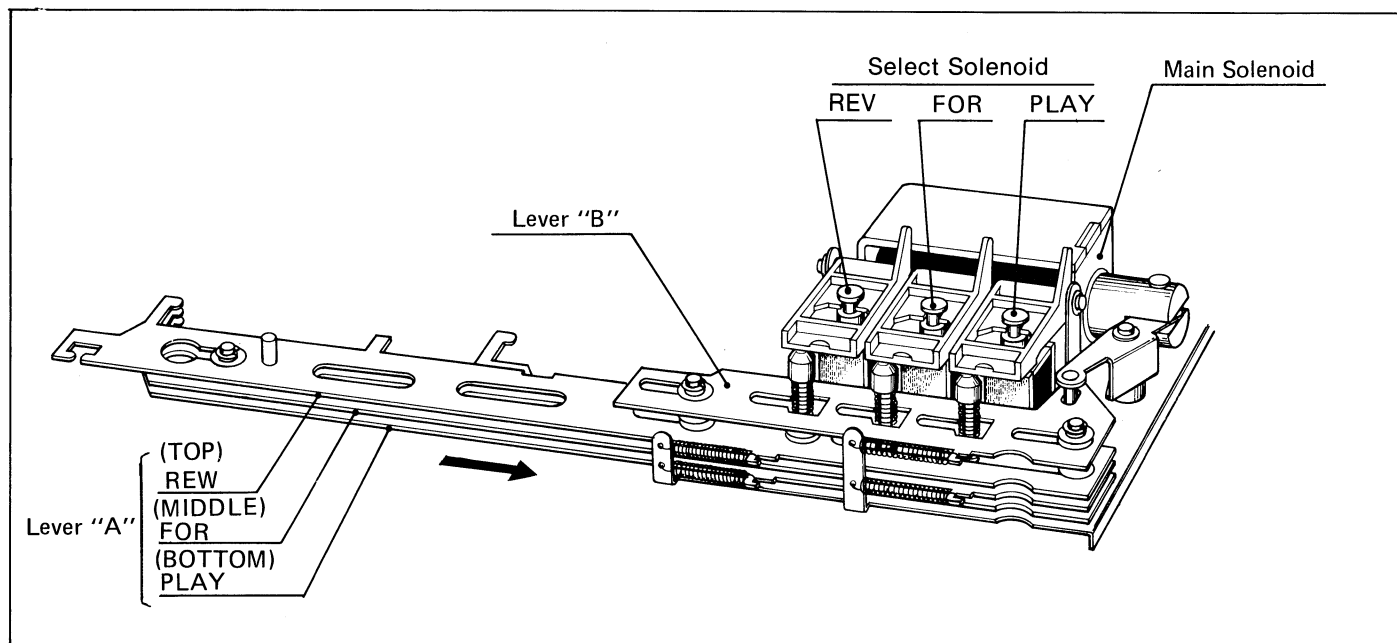


Fig. 16

CIRCUIT DESCRIPTION

Transport Control General Description

In earlier models of VCRs, the logic which accepted commands from the push buttons and energized the various circuits, motors, solenoids and lamps to create different modes of operation was discrete—transistors, diodes and so forth. Later generations of machines used IC components such as gates, flip-flops and multivibrators with a few transistors to create logic control circuits. The state-of-the-art has advanced to replace both these hard wired parts configurations with microprocessor based control. The microprocessor is a very small computer, and auxiliary or peripheral chips are used to expand the number of inputs and outputs of the computer to the number required by the control system being designed.

For inputs, the computer has all the push buttons, remote control functions, safety devices, tape sensors, and so forth. The outputs are coupled to the solenoids, record/play switching circuits, status lamps, servo drive circuits, and so on. In between these ins and outs is the microprocessor and its memory. See Figure 2-1.

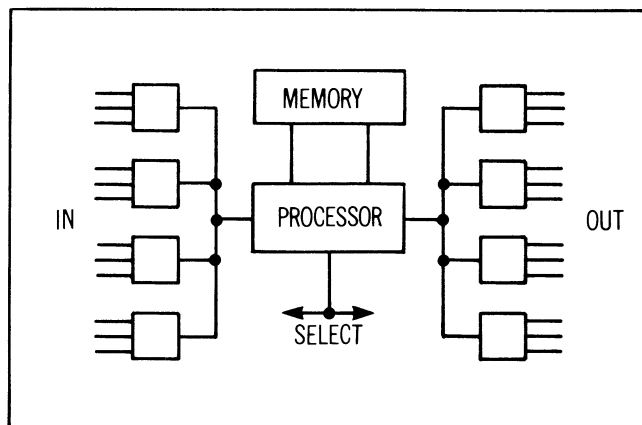


Figure 2-1

The unique aspect of this control system is that the microprocessor memory—called ROM (read only memory)—has been pre-programmed by the factory to recognize every input condition, and been given a logical, orderly set of instructions to follow for every eventuality.

Clearly, the instructions stored in memory (called the program) are the key. The processor by itself could do anything, but knows nothing. The virtues of this system are several. The parts count and cost are reduced significantly, so for the same cost, greatly increased sophistication of control is possible. Pre-production and production changes are easily made without rewiring; the memory chip is simply removed and one containing a slightly different set of instructions is installed.

Several models may be supported by a common system, with either a common program (memory) and a select point, or with a different program for each model.

For example, if you push the play button, the processor might follow this very simplified list of instructions:

Play

- Multiplex play button into A port
- Recognize "Play", light Play Lamp
- Check No Cassette or Cassette Position
- If cassette is not partially inserted
- Check cassette elevator for down
- If not, run cassette down
- Stop at down limit
- If no cassette. Stop
- Play lamp off
- If cassette, start loading process
- When subloading point is past
- Energize play select and main solenoid
- Turn on head cylinder servo
- Normal speed to capstan servo
- Upon completion of Loading
- Energize pressure roller solenoid
- Wait one second
- Switch from E-E electronics to playback electronics
- Start control track pulse count
- Convert and display as time count
- Check for End or Beginning of tape
- Check for change in operation

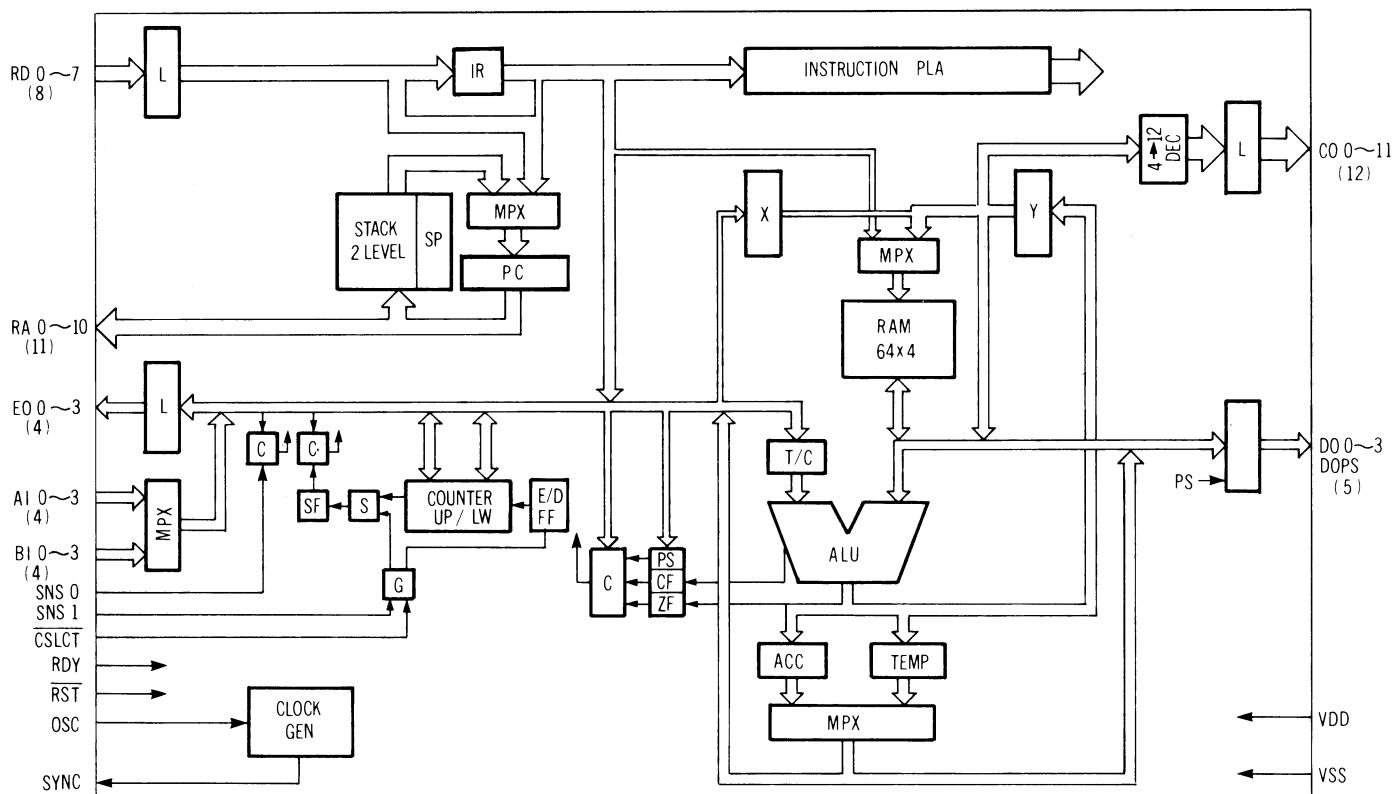
This microprocessor based system is possible because of the speed of the processor. Since it can only execute one instruction or accept one input or generate one output at any instant, it must be fast enough to appear to the user to be doing the tasks simultaneously.

MICROPROCESSOR

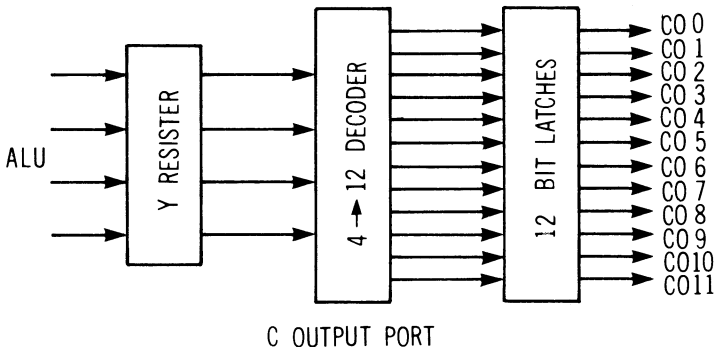
The microprocessor used in this system is an MN1499, a four bit device with an internal clock oscillator, an internal RAM (temporary memory whose contents is lost without power), an internal 8 bit event or interval counter, and provision for direct addressing of 2 K words of 8 bits in external ROM (read only program).

The MN1499 is primarily used for development, and as such is the most flexible of the MN1400 series. It therefore has external connections for test, single step and other modes not used in their system.

The following is a detailed outline of the architecture and organization of the MN1499.



Symbols	Meanings
MPX	Multiplexer
L	Latches
C	Comparing Circuit
S	Synchronizing circuit
G	Logical gates
ROM	Instruction Read Only Memory
PC	Program Counter
STACK	Subroutine stack register
SP	Stack pointer
IR	Instruction register
INSTRUCTION PLA	Programmable instruction decode circuit
RAM	Data RAM
X	X register
Y	Y register
DEC	4-bit data decoder
ALU	Arithmetic logic unit
T/C	"Truth or Complement" circuit
A	Accumulator
TEMP	Temporary register. This register is not addressable.
PS	"Program status" flag
ZF	"Zero" flag
CF	"Carry" Flag
COUNTER	Programmable 8-bit counter/timer
	UP: Upper, most significant 4-bits
	LW: Lower, least significant 4-bits
E/D	Counter/disable flip-flop
SF	Sense flip-flop
CLOCK GEN	Clock generator

SYMBOL	BLOCK	FUNCTION
AI 0 ~ 3	A Input port	4-bit parallel input port.
BI 0 ~ 4	B Input port	4-bit parallel input port.
CO 0 ~ 11	C Output Port	There are 12 discrete output lines. The Flip-flops for all twelve of these lines may be individually set or reset under program control.  C OUTPUT PORT
DO 0 ~ 3 DO PS	D Output Port	The D output port sends data from the D output latches, containing five bits.
EO 0 ~ 3	E Output port	The E output port is a parallel 4 bit output.
ALU	Arithmetic Logic Unit	The ALU performs the arithmetic and logical operations: addition, increment, Boolean logic AND, OR, Exclusive OR, ADD and transfer.
ACC	Accumulator	The four-bit primary working register.
TEMP	Temporary	A four-bit register used for internal program execution.
PS	Program Status	The PS is a one bit user controlled flag. See the D port output.
CF	Carry Flag	The CF is a Carry flip-flop. The CF is set when a carry is generated. The CF is tied with the ALU and used to perform binary arithmetic.
ZF	Zero Flag	The ZF is set if the result of data processing is zero and is reset if the result is not zero.
RAM	The Random Access Memory	The random access memory (RAM) consists of 64 words of 4-bits each. This memory is used for Timers, Counters and to hold intermediate results.
X	X register	The X register is a 3 bit register for RAM address.
Y	Y register	The Y register is a 4 bit register which addresses the RAM and the C output port.
PC	Program Counter	The program memory addressing consists of an 11 bit program counter and two 11 bit stack registers.

SYMBOL	BLOCK	FUNCTION
Stack	Stack	Two level 11 bit registers to store the previous program address during the execution of a subroutine.
ROM (External)	Read Only Memory	The external read only memory (ROM) provides for the storage of 2048 bytes of 8 bits each for instructions and constants for the MN1499, addressed by the program counter.
IR	Instruction Register	Eight-bit register holding the instruction from the ROM during the execution cycle.
PLA	Instruction PLA	Internal logic decoding of the instruction.
Counter Timer	Counter	The counter/timer is a programmable 8-bit, two byte (LW; UP) binary counter. The low-to-high transition on the SNS1 pin causes it to increment.
L	Latch	Output ports are all latched to hold the data from the processing circuit.
DEC	Decoder	It converts the contents of the Y-register to 12 bits for the C output.
SP	Stack Pointer	Register holding the address of the stack.
MPX	Multiplexer	Two 4 bit input ports time share a single data bus.
SF	Sense flip-flop	SF is set when the counter becomes 0.
E/D FF	Counter Enable	Counter Enable/Disable flip flop (CSLCT).
S	Synchronizing	Counter synchronizing circuit.
C	Compare	Comparing circuit; does not alter the memory or register.
G	Gate	Counter input Gate circuit.
T/C	True/Complement	Circuit to transfer either the data or the one's complement.
CLOCK	Clock Gen.	Makes 3 phase clock signal from oscillator.
SNSO	Sense Input	Unmultiplexed input to request program branch.
SNS1	Sense Input	Counter timer input.
RST	Power On Reset	The RST input insures an initialized start.
OSC	Oscillator	Connection point for external R/C components or 300 kHz source.
TST	Test Input	Test terminal for the LS1.
VDD	Power Input	VDD voltage (+5V).
VSS	Power Input	Ground (0V).

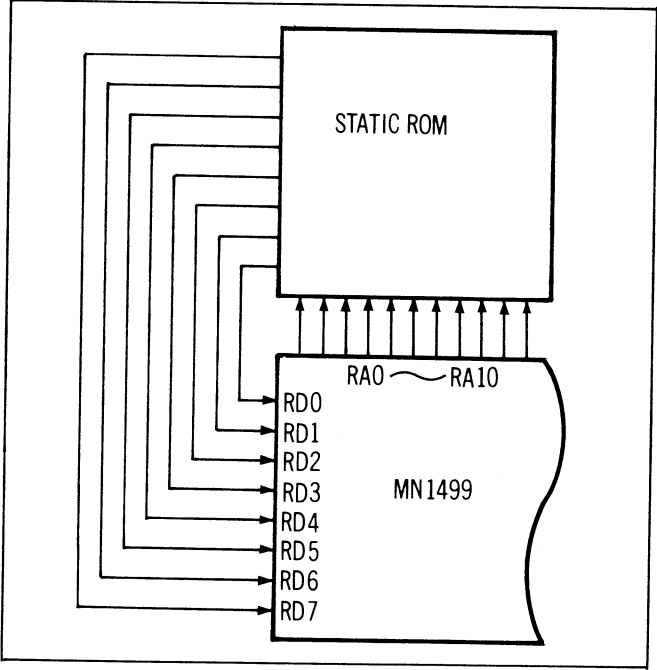
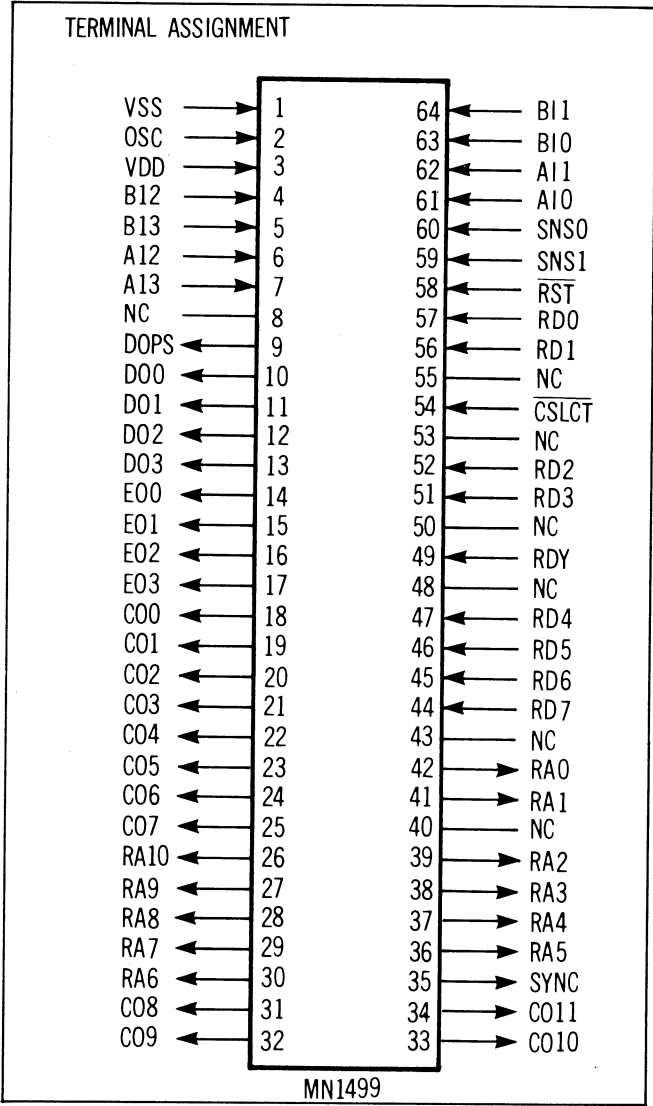


Figure 2-2

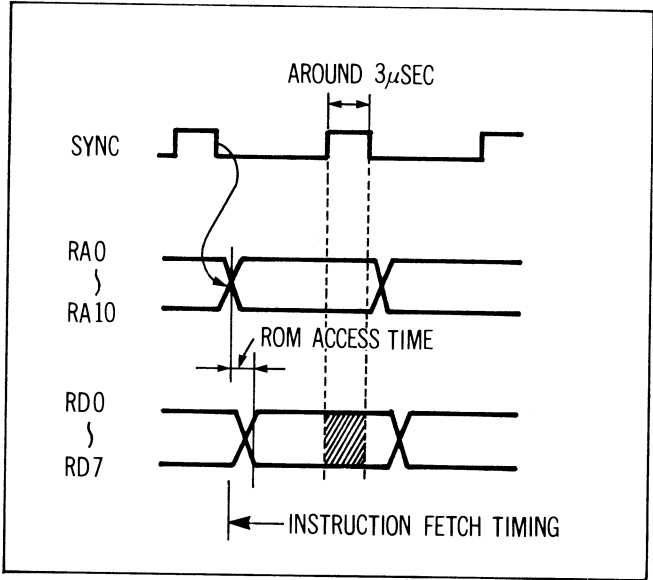


Figure 2-3

Since the program memory is external, it is connected to the microprocessor by an address bus of eleven bits (RA0-RA10), and data sent back to the processor by an eight bit data bus (RD0-RD7) (See Figure 2-2). After a new address is presented to the memory, a finite time elapses until the new instruction data is available on the data bus, called access time.

The processor allows for this, and actually uses the data during the instruction fetch time. (See Figure 2-3).

For use with the MN1499 the access time must be less than 2 μ seconds.

The memory is ultra-violet erasable, electrically programmed using special systems and devices. Once the program is stored, it will stay without power, unless the IC window is exposed to high energy UV light.

The program data or instructions are stored in a 16,384 (16K) bit cell matrix, which is organized as 2048 (2K) words 8 bits wide. This fits exactly with the processors 11 address bits and 8 instruction data bits. The chip enable/program input is used for programming, when data must be read into the memory, and the output enable (OE) would be used if multiple memory ICs were needed. (See Figure 2-4)

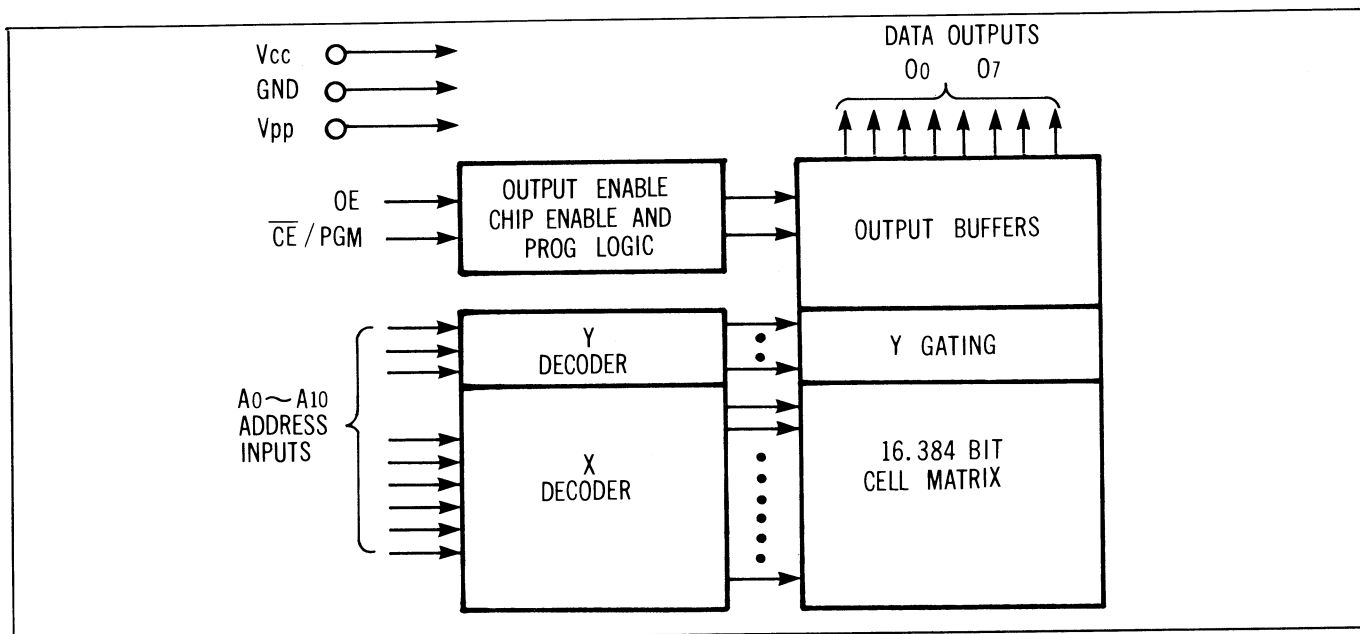


Figure 2-4

If the memory and the microprocessor are treated as a single block, since neither can stand alone, only data inputs and outputs remain. The single block may be called the MPU (Figure 2-5).

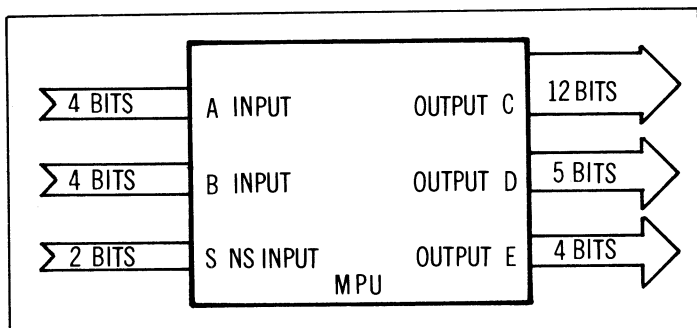


Figure 2-5

INPUTS

Since with two 4 bit inputs there are only eight input terminals, and the VCR has many more devices (switches, photo sensors, remote control terminals) which require access to the control logic contained within the MPU, an input multiplexing system must be used. The building block for this system is the M1201 input multiplexer, which performs two functions. One of the two 4 bit inputs (called A and B) is selected by a series of gates which are controlled by the A select input (A SEL). (See Fig. 2-6)

If this is high, the A input is taken; if low, the B input is active. After the switching gates, the selected input (A or B) data passes to tristate buffers.

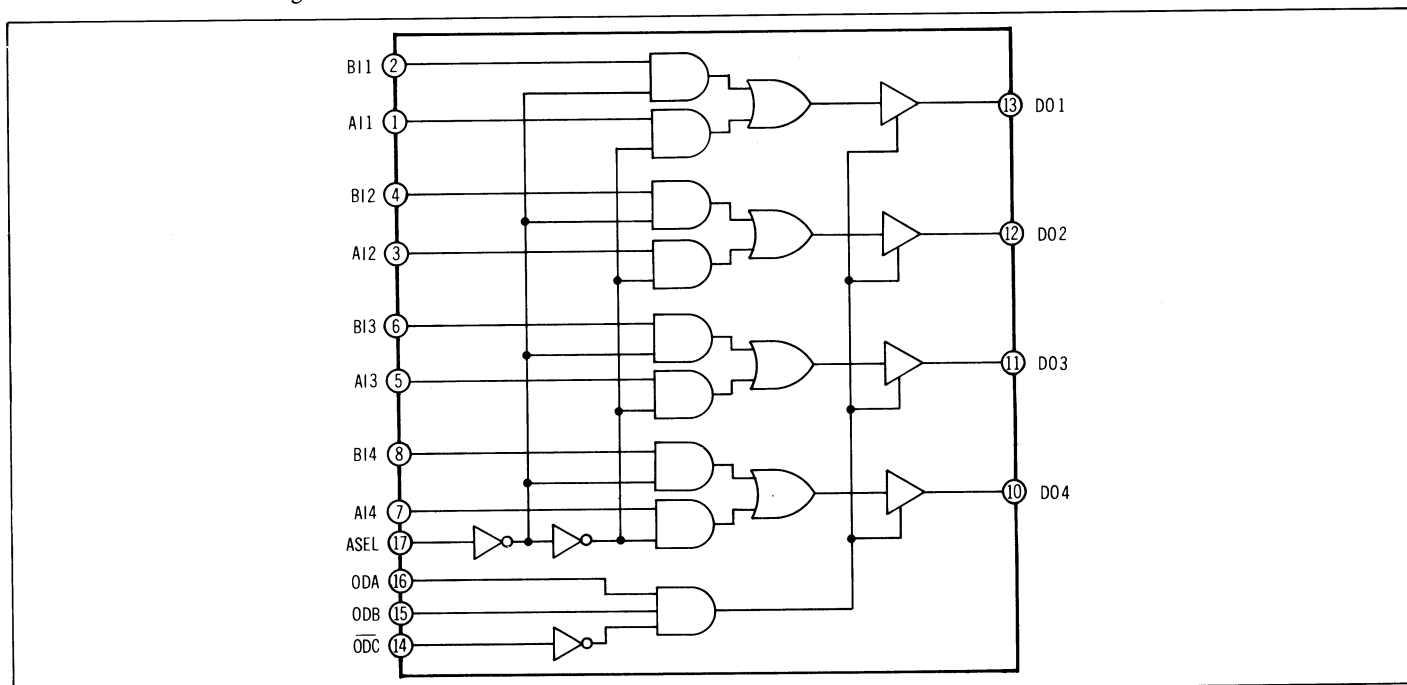


Figure 2-6

Terminal	Function	Description
AI1~AI4	4-bit Input	Selected for the output when "ASEL" is high.
BI1~BI4	4-bit Input	Selected for the output when "ASEL" is low.
ASEL	A Select Input	ASEL H AI1 AI4 ASEL L BI1 AI4
ODA ODB $\overline{ODC}$	Chip Select Input Terminal	ODA ODB = 1, ODC = 0 OUTPUT DATA ODA ODB = 0, ODC = 1 High Z (No Output)
DO1~DO4	4-bit Output	Tristate Data Output

Figure 2-7

These buffers can be disabled so that regardless of the data at the input, the output floats in a high impedance mode. This is used to enable or select this IC from many which may be connected in parallel.

The enable function is available at three inputs (OD A, B, C), with ODC inverted for negative logic (active low).

(See Figure 2-7)

This system requires 50 control inputs, of which 48 are multiplexed (2 go to SNS0 and SNS1). Recall that the MPU had two 4 bit input ports, A and B.

One MN1201 multiplexer would expand one port to two, as shown in Figure 2-8.

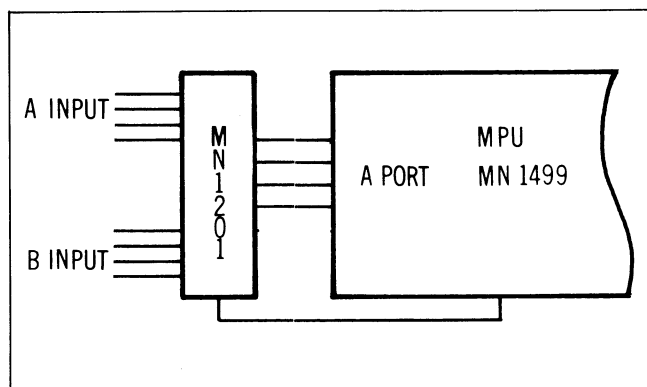


Figure 2-8

Since the MPU must know which input terminals are actually enabled to the A port, the control of the MN1201 comes from the MPU.

This system requires 50 control inputs, of which 48 are multiplexed (2 go directly to the microprocessor, inputs SNS0 and SNS1). Recall that the MPU had two 4 bit input ports, A and B.

In the actual system, there are three IC multiplexers for each port, so the A port of the MPU has three A inputs and three B inputs, and the B port also has three A and three B inputs. This total of 6 A inputs and 6 B inputs each with four bits is the 48 needed.

The microprocessor or MPU enables only one input for each port at a time so it can tell what the four bits mean. The program activates the first 4 bits of the C output port for this purpose. Since the MPU can take in data on the A and B ports simultaneously, the multiplexers are enabled in pairs by C output bit 0, 1 or 2. Only one of these three bits is active at one moment. A/B selection is done by C output bit 3, and it affects all the input multiplexers at once. However, only the pair enabled by C0 or C1 or C2 actually are active. Note that the A select is active high, but the IC select ODC is active low.

(See Figure 2-9)

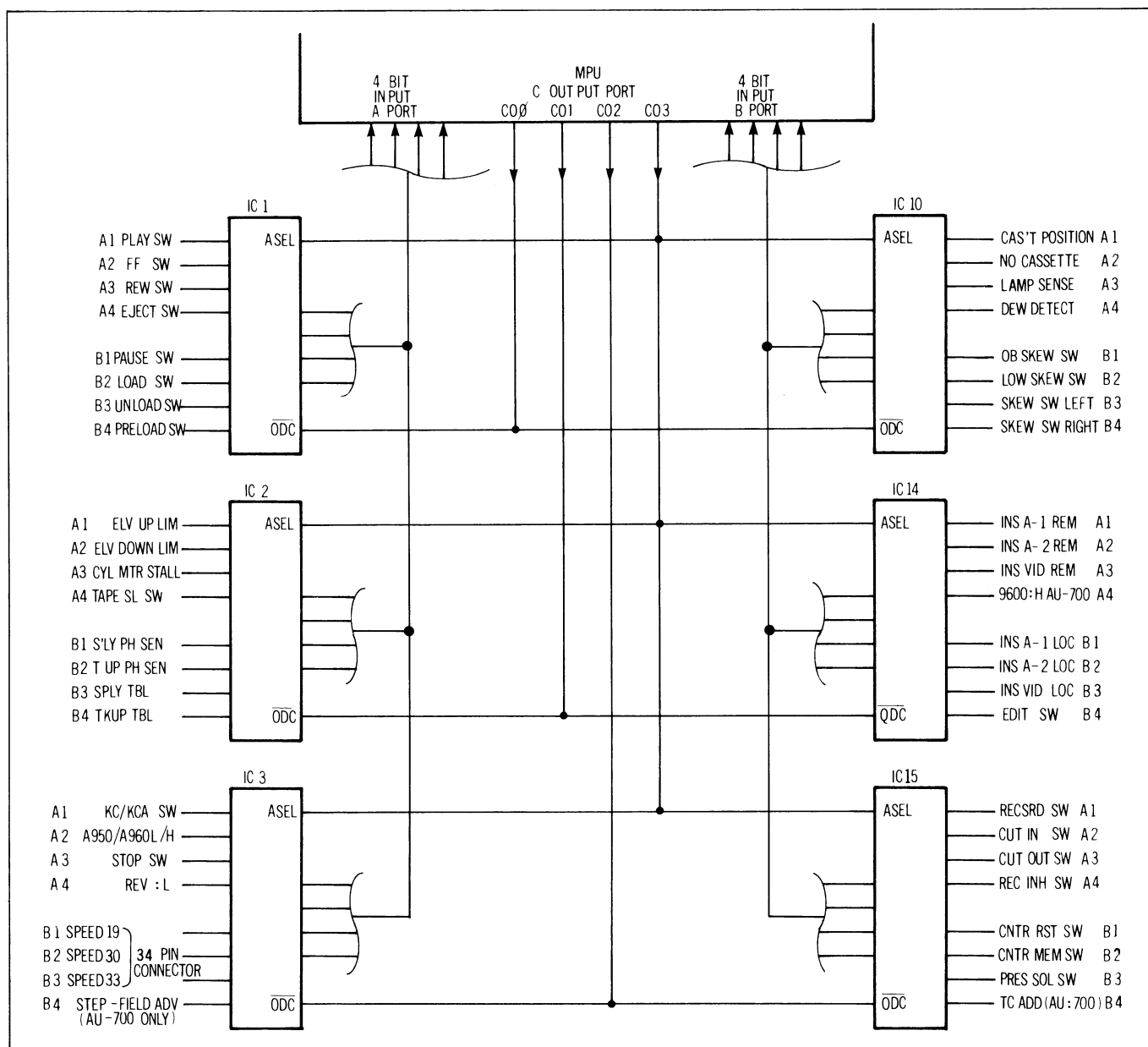


Figure 2-9

Each A or B input of each IC has a dedicated function. The following table illustrates the function by IC and the C output bit which enables it.

MICROPROCESSOR PORT A INPUTS

IC	ENABLE		NAME	FUNCTION																								
IC1	COφ	A1	Play SW	Low when the play button is pressed.																								
		A2	Fast Forward SW	Low when the FF button is pressed.																								
		A3	Rewind SW	Low when the REW button is pressed.																								
		A4	Eject SW	Low when the Eject button is pressed.																								
		B1	Pause SW	Low when the Pause button is pressed.																								
		B2	Loading SW	This switch opens when loading is completed.																								
		B3	Unloading SW	This switch opens when subloading is completed.																								
		B4	Pre Unloading SW	Closes when complete unloading is finished.																								
IC2	CO1	A1	Up SW	Closes when the cassette compartment is fully raised.																								
		A2	Down SW	Closes when the cassette compartment is fully lowered.																								
		A3	Motor Lock H	If the cylinder motor is stalled, a high initiates stop.																								
		A4	Safety SW	High if the tape slack occurs. Unload inhibit and Stop.																								
		B1	Supply Photo-sense	Low, when leader is detected at the end of the tape.																								
		B2	Take up Photo-sense	Low, when leader is detected at the beginning.																								
		B3	Supply Reel Table	Hall Effect Ic output for motion sense.																								
		B4	Take up Reel Table	Hall Effect IC output for motion sense.																								
IC3	CO2	A1	KC/KCA SW	Low to release tension and mute video for KC tape.																								
		A2	A950 - A960 SW	Manual Switch. NV-A950 is low, high for NV-A960.																								
		A3	Stop SW	Low when the Stop button is pressed.																								
		A4	Rev : Low	Low to produce the Reverse mode.																								
		B1	Speed 19	<table><tr><td></td><td>1/20</td><td>1/5</td><td>X1</td><td>X2</td><td>X5</td></tr><tr><td>19</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr><tr><td>30</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>33</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td></tr></table>		1/20	1/5	X1	X2	X5	19	1	1	1	0	0	30	0	0	1	1	1	33	0	1	1	1	0
			1/20	1/5	X1	X2	X5																					
		19	1	1	1	0	0																					
		30	0	0	1	1	1																					
33	0	1	1	1	0																							
B2	Speed 30																											
B3	Speed 33																											
B4	Step Advance	Not Used NV9600/Field Advance.																										

MICROPROCESSOR PORT B INPUTS

IC	ENABLE		NAME	FUNCTION
IC10	CO ϕ	A1	Cassette Position	Low if the cassette is inserted completely.
		A2	No Cassette	Low if the cassette door is open.
		A3	Lamp Cut	High when the photo sensor LED source is out.
		A4	Dew	Low when dew is detected.
		B1	Skew SW Upper : (H)	High, when the skew motor is fully counter-clockwise, the skew motor stops.
		B2	Skew SW lower : (L)	Low, when the skew motor is fully clockwise, the skew motor stops.
		B3	Skew Lever SW Left	Low to make the skew motor rotate clockwise.
		B4	Skew Lever SW Right	Low to make the skew motor rotate counter-clockwise.
IC14	CO1	A1	Insert A1 (Remote)	Low to hold the unit in the audio CH1 insert editing mode.
		A2	Insert A2 (Remote)	Low to hold the unit in the video insert editing mode.
		A3	Insert V (Remote)	Low to hold the unit in the video insert editing mode.
		A4	9600, 9240/700	Model select. Low for AU700, High for NV9600.
		B1	Insert A1 (Local)	Low to set the unit in the audio CH1 insert mode.
		B2	Insert A2 (Local)	Low to set the unit in the audio CH2 insert mode.
		B3	Insert V (Local)	Low to set the unit in the video insert mode.
		B4	Edit SW	Low when the edit button is pressed for assembly editing.
IC15	CO2	A1	Rec SW	Low when the Record button is pressed.
		A2	Cut in SW	Low when the Cut In button places the unit into insert.
		A3	Cut out SW	Low when the Cut Out button ends insert editing.
		A4	Rec Inhibit SW	Cassette record inhibit sense. Low to Record.
		B1	Counter Reset SW	Low when the counter reset button resets the counter.
		B2	Counter Memory SW	Low to enable the Counter to detect 00 and half Rew or FF.
		B3	Pressure Roller SW	Low if the Pressure Roller is withdrawn.
		B4	T/C Track A : (H)	High for T/C record in Audio 1, Low the T/C address track.
SNS ϕ			Safety SW	Low to immediately begin Eject. Finger Protection.
SNS1			Counter Pulse	Control signal (CTL) from the tape for time display.

OUTPUTS

The MPU by itself has three output ports: C with 12 bits, D with 5 bits and E with 4 bits (See Figure 2-4). Control of the system requires 60 outputs, with 5 of those for multiplexing. Therefore, the 21 bits of the MPU must be expanded. In addition, outputs, unlike inputs, must have the ability to latch or store the data for that bit until a change is sent from the MPU. For example, if one bit lights the Play lamp, it must remain on until the Play mode ceases, even while the MPU is addressing another output. Output expanders, here the 8243, are used. These ICs are actually bidirectional Input/Output expanders, with some internal logic ability, but in this system they are used only for output expansion. The input port from the MPU is called Port 2, and there are four 4 bit outputs called Port 4, 5, 6 and 7. Note that in the pin configuration the ports are marked by P followed by port number and then bit number, i.e. P71 is port seven, second bit. See Figure 2-10, 2-11.

Since port 2 can connect to any of the 4 output ports, addressing is required. The address of the desired output is carried in the first two bits of a data word which is sent to Port 2 preceeding the output data. The IC knows which is address and which is data because of the program pin status. See Figure 2-12.

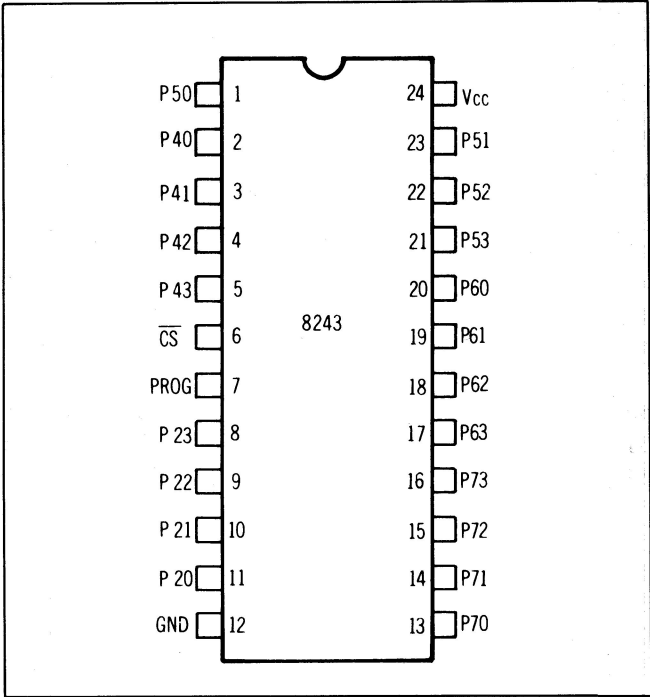


Figure 2-10

CONTROL AND ADDRESS SIGNAL (ONLY WRITE MODE IS USED.)

P20	P21	PORT ADDRESS	P22	P23	CONTROL
0	0	PORT 4	0	0	READ
1	0	PORT 5	1	0	WRITE
0	1	PORT 6	0	1	OR
1	1	PORT 7	1	1	AND

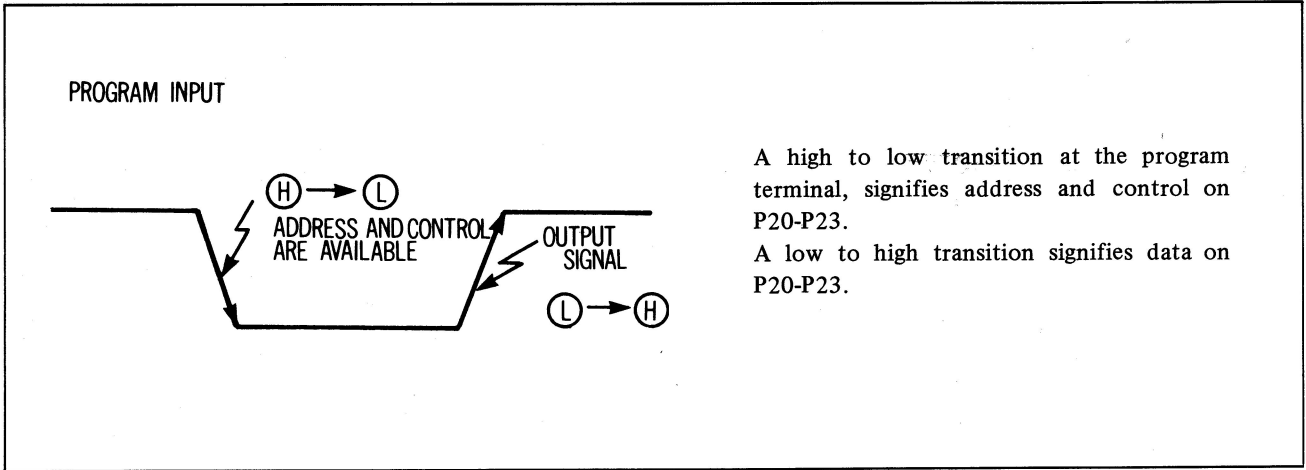


Figure 2-12

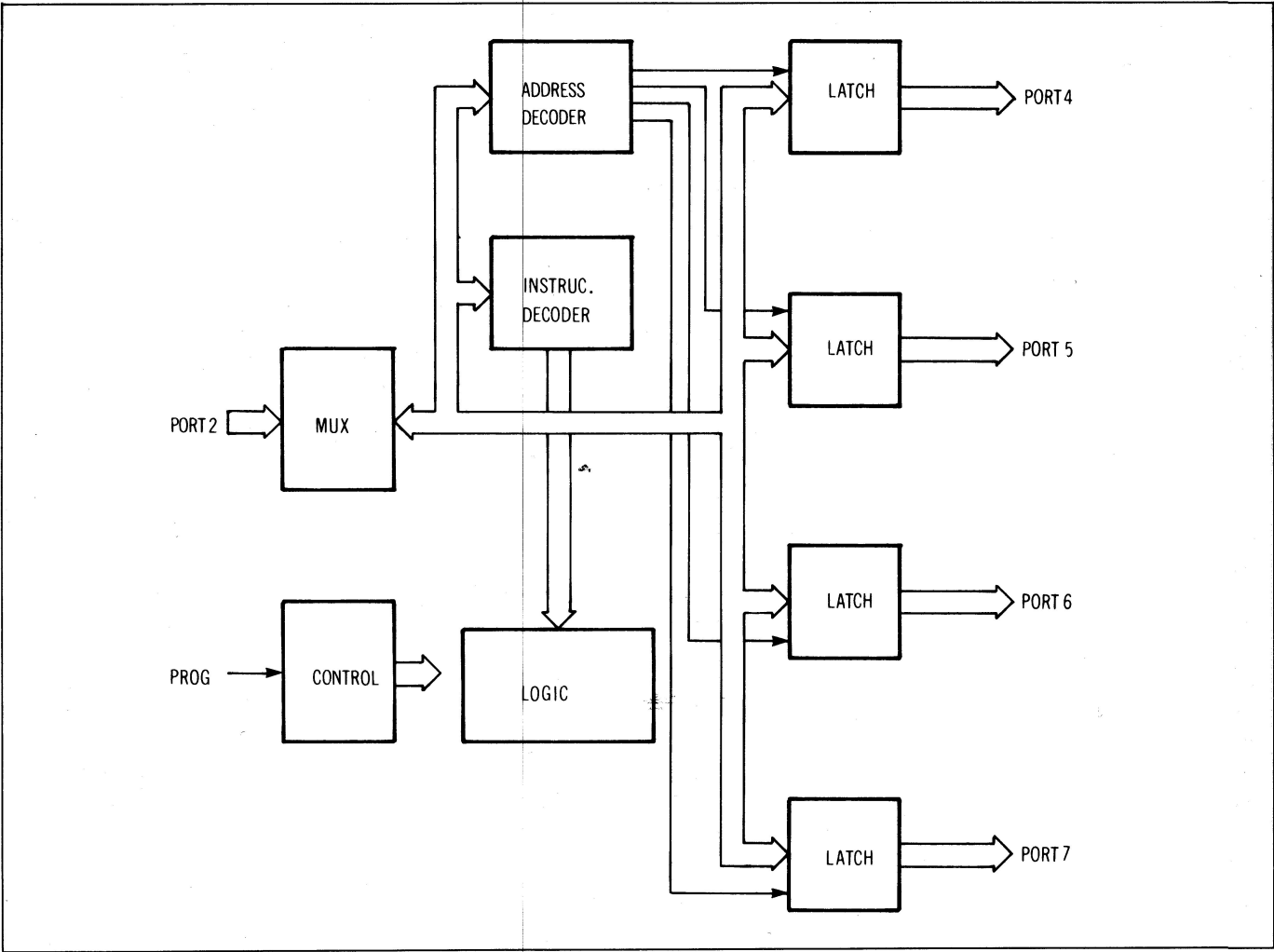


Figure 2-11

Since each IC has four 4 bit ports, or 16 bits, three such ICs are required for 48 output bits.

The chip select pin enables one and only one of the output expanders, depending upon the C0-C2 outputs, which are also used for input multiplexing. Data is gotten from the E port of the MPU, therefore, and stored in one of 12 latches, 4 bits at a time.

Therefore, the program can enable a C output (0, 1, or 2) (low) to select one of the three expanders, put out a 4 bit

word at the E port to select which of the four ports will receive the data, and then change C output C4 from high to low. This is the program signal port select command for that IC expander. Now the program in the MPU will present the actual data to be stored at the E port, and the C4 output will be made to go back high. This will cause the data to be stored in the proper output port of the proper expander IC. See Figure 2-13.

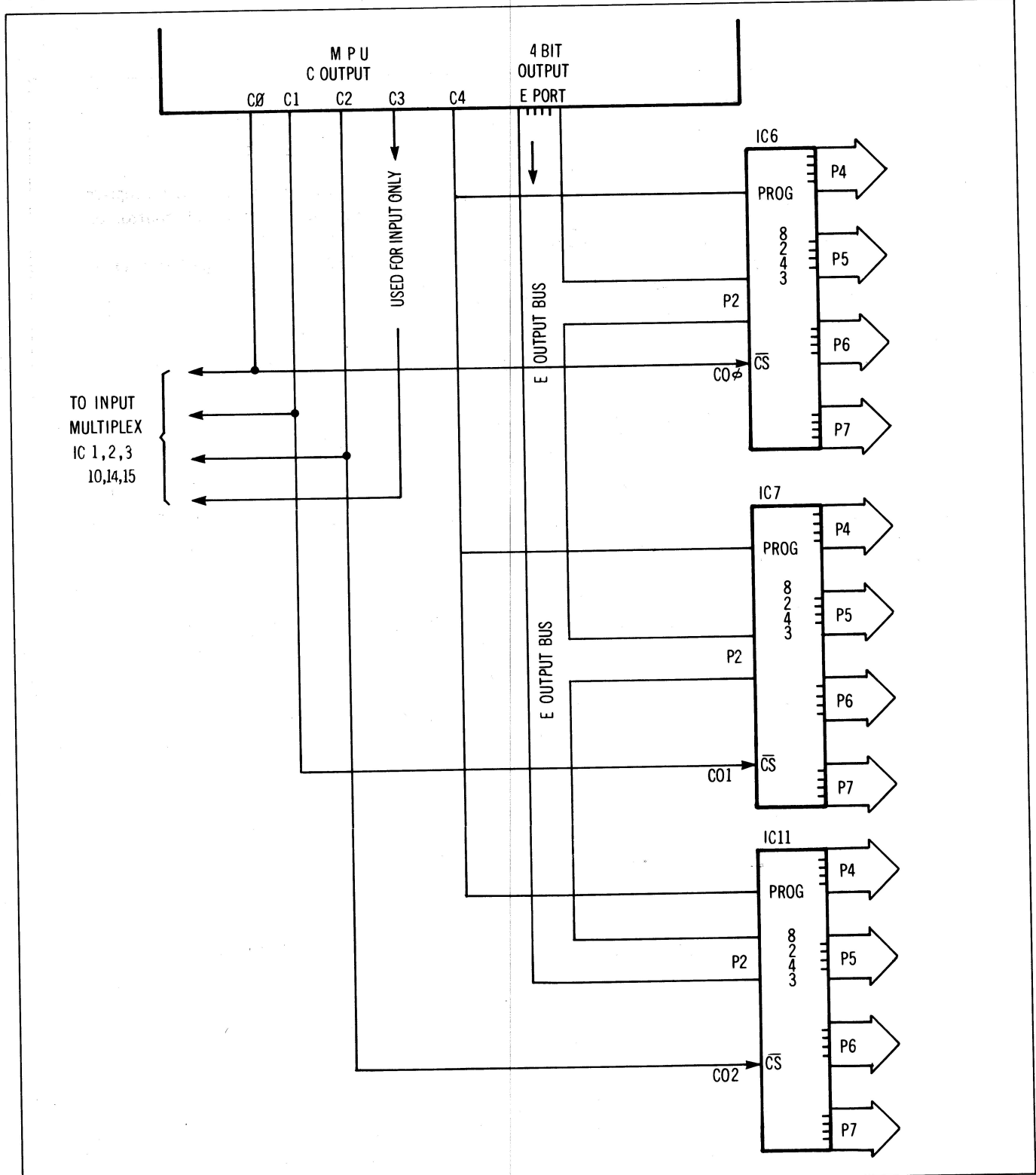


Figure 2-13

Since each pin of each output port of each expander has a dedicated function, the chart below shows those functions.

E Output Port Expansion

IC4 EO 0-3

IC 6		ON
ENABLE COφ		
40	Reel Servo Play	L
41	Reel Servo FF/Rew	H
42	Skew Tension Up	H
43	Skew Tension Down	H
50	Loading	H
51	Unloading	H
52	Up Cassette	H
53	Down Cassette	H
60	Play Select Solenoid	H
61	Fast Forward Select sol.	H
62	Rewind Select Sol.	H
63	Main Solenoid	H
70	Reverse Mode	H
71	Frame Adv. (AU-700)	L
72	Rev. Band Solenoid	H
73	Pause & KCA (Norm. Mode)	H

IC 7		ON
ENABLE CO1		
40	Audio CH1 E-E (Play)	H
41	Audio CH2 E-E (Play)	H
42	Video E-E (Play)	H
43	Flying Erase	H
50	Audio CH1 Record (R/P)	H
51	Audio CH2 Record (R/P)	H
52	Video Record (R/P)	H
53	CTL/Full Erase (R/P)	H
60	A CH1 Insert Lamp	H
61	A CH2 Insert Lamp	H
62	Video Insert Lamp	H
63	Audio Muting	H
70	Pause Lamp	H
71	Record Lamp	H
72	Insert Lamp	H
73	Video Muting	L

IC11		ON
ENABLE CO2		
40	SEC	H
41	10 SEC	H
42	MIN	H
43	10 MIN	H
50	a	L
51	b	L
52	c	L
53	d	L
60	e	L
61	f	L
62	g	L
63	+/- minus	L
70	CTL Play Muting	H
71	STB Lamp ON :	H
72	Counter "0" out ON :	H
73	Warning Lamp ON :	H

Figure 2-14

D Output Port

IC4	DO 0-3	ON
D0	Play Lamp	H
D1	Fast Forward Lamp	H
D2	Rewind Lamp	H
D3	Eject Lamp	H
DOPS	Cylinder Motor	L

C Output Port

IC4	CO 0-11	ON
C0	IC 1, 6, 10 CS	L
C1	IC 2, 7, 14 CS	L
C2	IC 3, 11, 15 CS	L
C3	Input A select (B)	H
C4	Output Program	
	H → L Port Sel. Store	
	L → H Data Store	

C5	X5	L
C6	X2	L
C7	X1	L
C8	X1/5	L
C9	X1/20	L
C10	TC Rec.	L
C11	Pressure Solenoid	H

Figure 2-15

The expansion of the E port is not the only output of the system. The D port provides 5 bits and the C port has 12 bits which are not multiplexed. The C port bits 0 through 4 are used for I/O multiplexing as described above. Port bits 5 through 9 are used for speed selection. The processor accepts the inputs from three remote control pins of the 34 pin connector (19, 30, 33) and translates them into a one of five exclusive output (C5-9). See Figure 2-15, 2-16.

Bit C10 enables the Time Code record/play circuit and C11 activates the Pressure roller solenoid.

Port D lights the four main function lamps and enables the Cylinder motor.

SPEED	1/20	1/5	1	2	5
PIN 19	1	1	1	0	0
30	0	0	1	1	1
33	0	1	1	1	0

1 - HIGH, 0 - LOW

PIN 17
FORWARD - HIGH (1)
REVERSE - LOW (0)

Figure 2-16

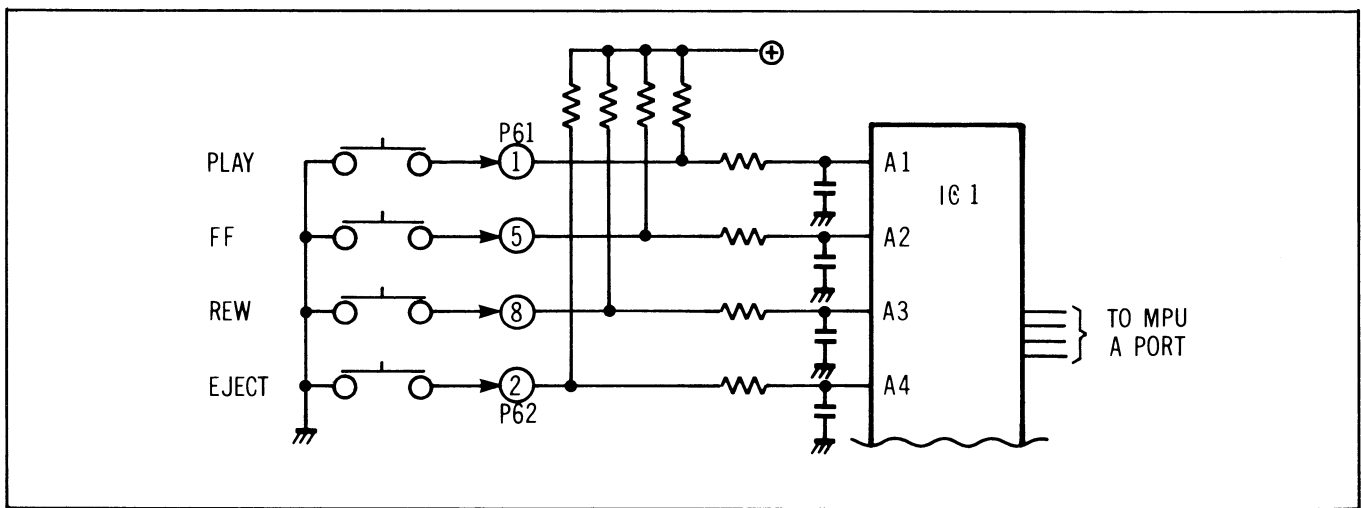


Figure 2-17

Control System Input

Inputs to the control system may be categorized into three groups: Push button/switches, Remote Control, and Special Inputs.

The front panel push buttons are momentary contact devices which ground a normally high input to one of the input multiplexers. This prevents positive going noise spikes from false triggering the logic. The limit and safety switches, which are not a momentary function, work in the same fashion, except the mechanical action of the transport holds them on. See Fig. 2-17.

The inputs from the 34 pin remote control connector fall into two groups. The mode select control inputs-Play, Fast Forward, Record, Cut-In, Cut-Out, etc-simply parallel the front panel controls. However, the speed and reverse inputs require a constant input to alter the VCR normal mode. Pins 19, 30 and 33 are used for speed select, and pin 17 is for Reverse. When no connection is made, these pins are pulled high resistively. These pins the remote controller must hold low to cause the unit to go a speed other than X1, or reverse. For static protection, these inputs are buffered by IC30. See Figure 2-18.

For static protection, these inputs are buffered by IC30.

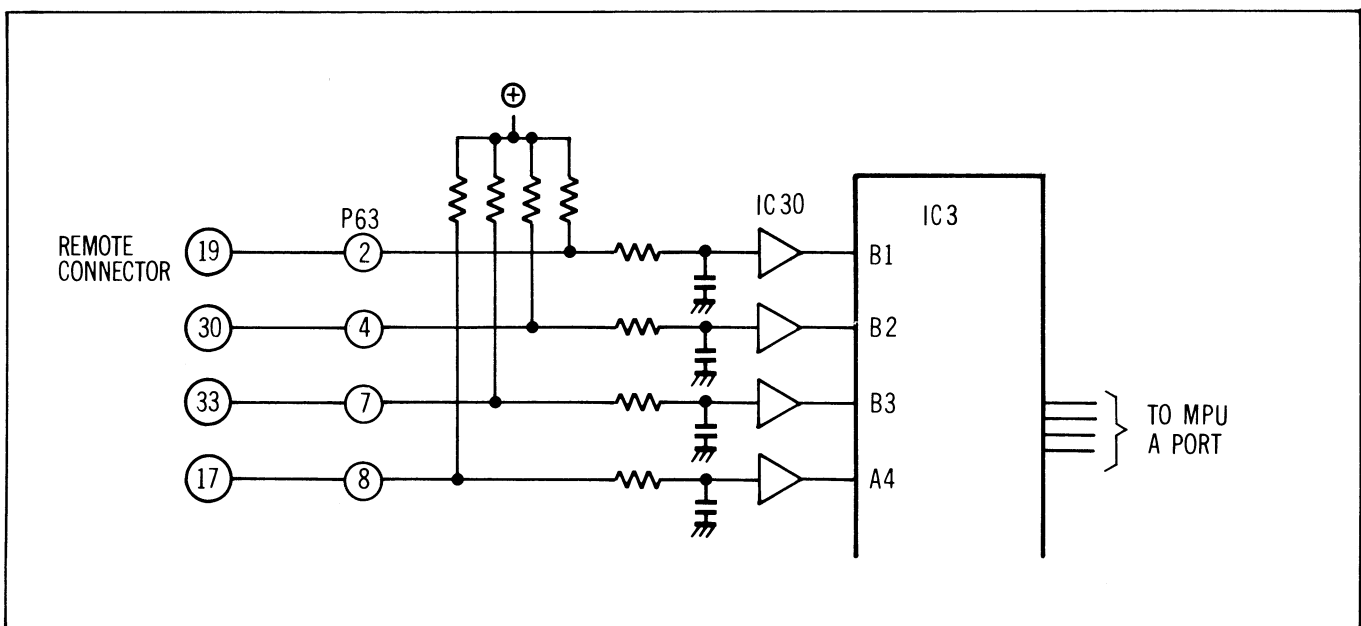


Figure 2-18

The limit and safety switches include the Elevator Up and Down limits; the Pre-loading, Unloading and Loading switches, the KC/KCA and Record Inhibit switches, the No Cassette and Cassette Position (2) switches, the Skew Cam Sense switches and the Pressure Roller switch. See Figure 2-19.

Special Inputs

The special inputs are those generated by other circuits, such as the Dew detector and Photo transistors. See Figure 2-24 for an overall diagram of the end of tape sense circuit.

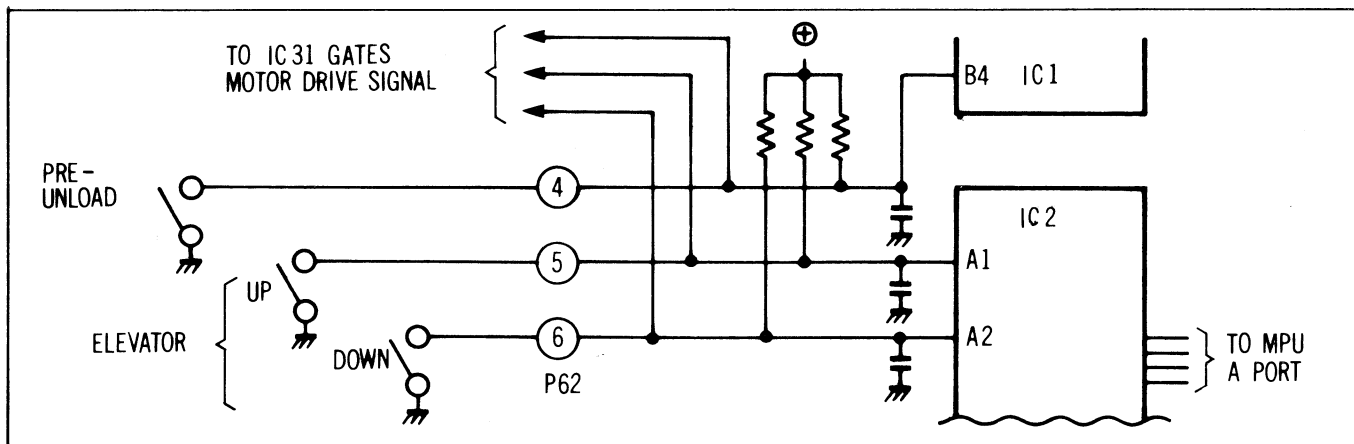


Figure 2-19

Photo Sensor Circuit

To detect the clear leader at beginning of tape and end of tape for tape protection, photo transistors and infrared light emitting diodes (LED) are used.

This infrared LED has a current limitation, so it is pulsed. An Opamp, IC9-8, 9 and 10, forms a 300 Hz oscillator to drive the infrared LED at a 1:10 duty cycle. See Fig. 2-20.

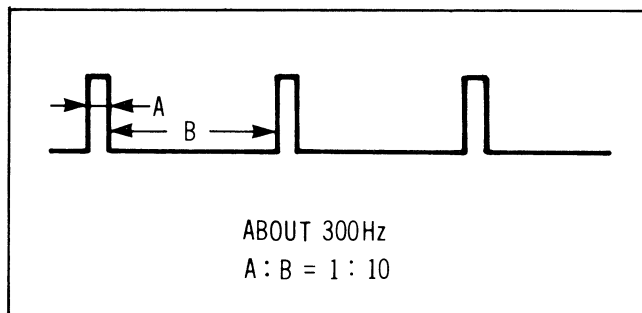


Figure 2-20

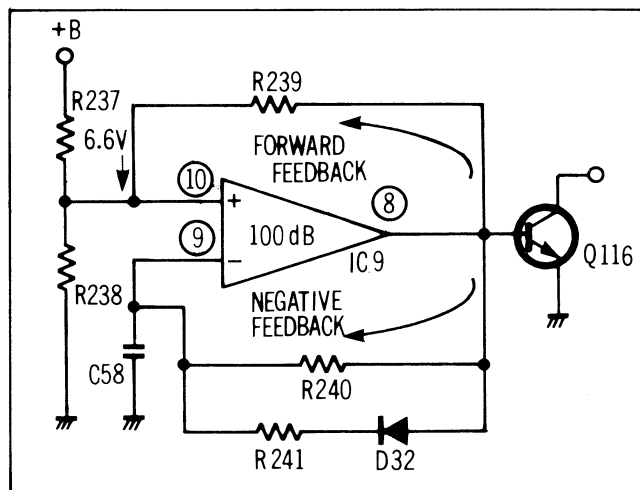


Figure 2-21

Figure 2-21 shows a simplified schematic.

C58 starts to charge through R240, R241 and D32, and the charged voltage is compared with the 6.6 volts which is made by R237 and R238.

When the charged voltage reaches 6.6V, the output pin (8) goes low. Then C58 starts to discharge through R240 until the voltage becomes 5.4 V, at which point the output reverts to a high. (See Figure 2-22)

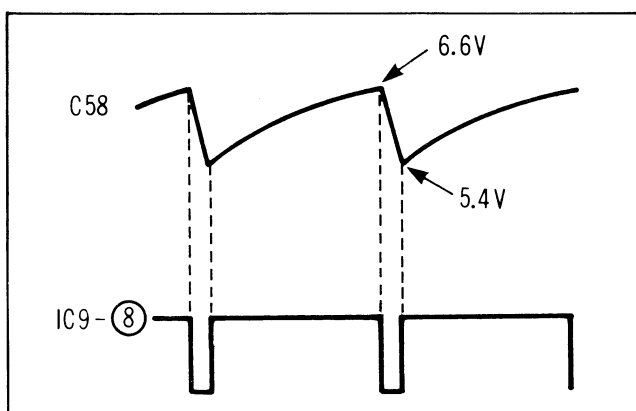


Figure 2-22

When no tape or the translucent leader is present, the photo transistor is exposed to the LED, and it turns on. As can be seen Fig. 2-23, two stages of IC9 form inverting comparators.

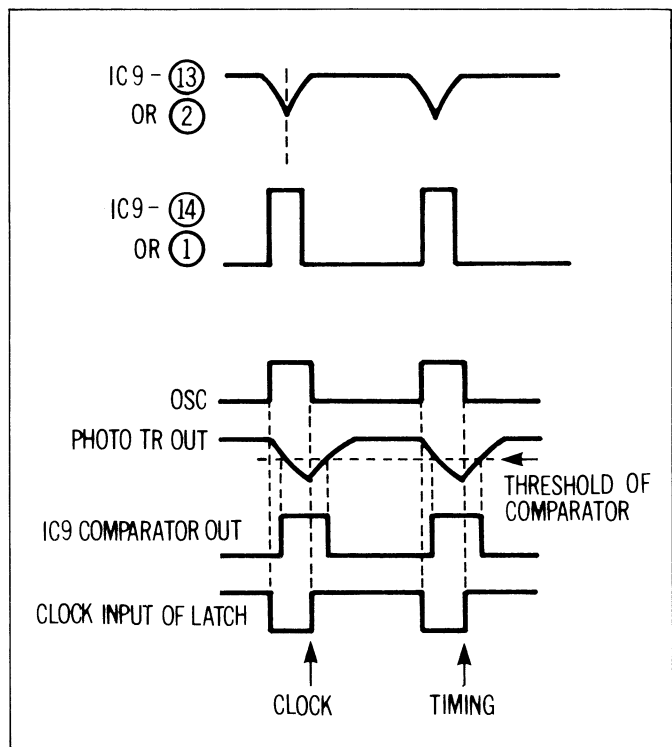


Figure 2-23

The output of this comparator is supplied to a D type Flip-Flop, as a data (D) input. The same 300 Hz pulse that drives the LED is supplied to the flip-flop as a clock pulse. In this circuit, the level at D will be clocked to the Q output on the rising edge of the clock pulse. The Q output becomes a high if the leader is present, or if there is no tape.

This arrangement of clock and D type Flip-Flop assure that the photo transistors are only interrogated when the LED is on. (See Figure 2-25)

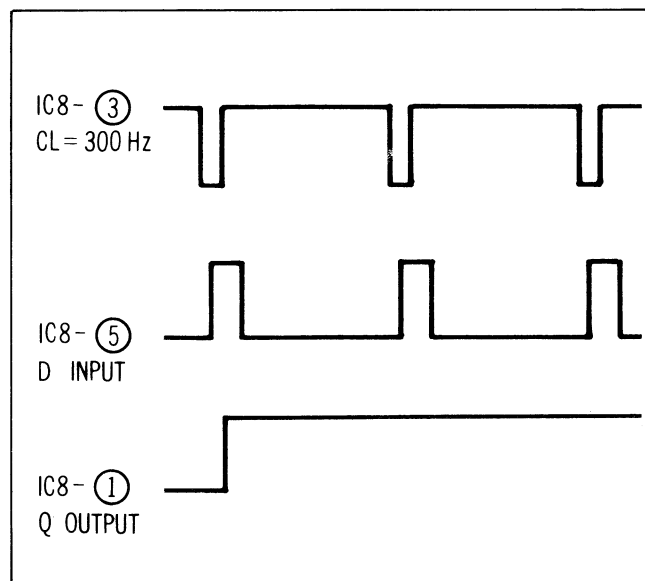


Figure 2-25

Dew Detector

The Dew detector element is a resistive device whose resistance increases with relative humidity, rapidly starting at about 94%.

When the resistance of the dew detector increases, the normally high output of IC13 (1) goes low. This will stop the unit and cause the warning lamp to light. See Fig. 2-26.

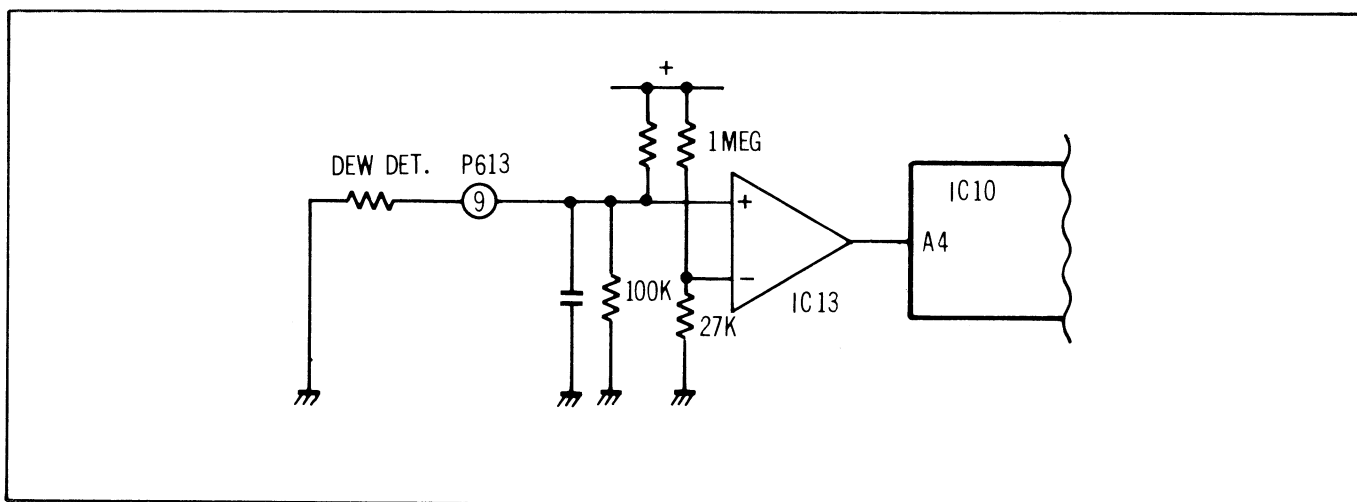


Figure 2-26

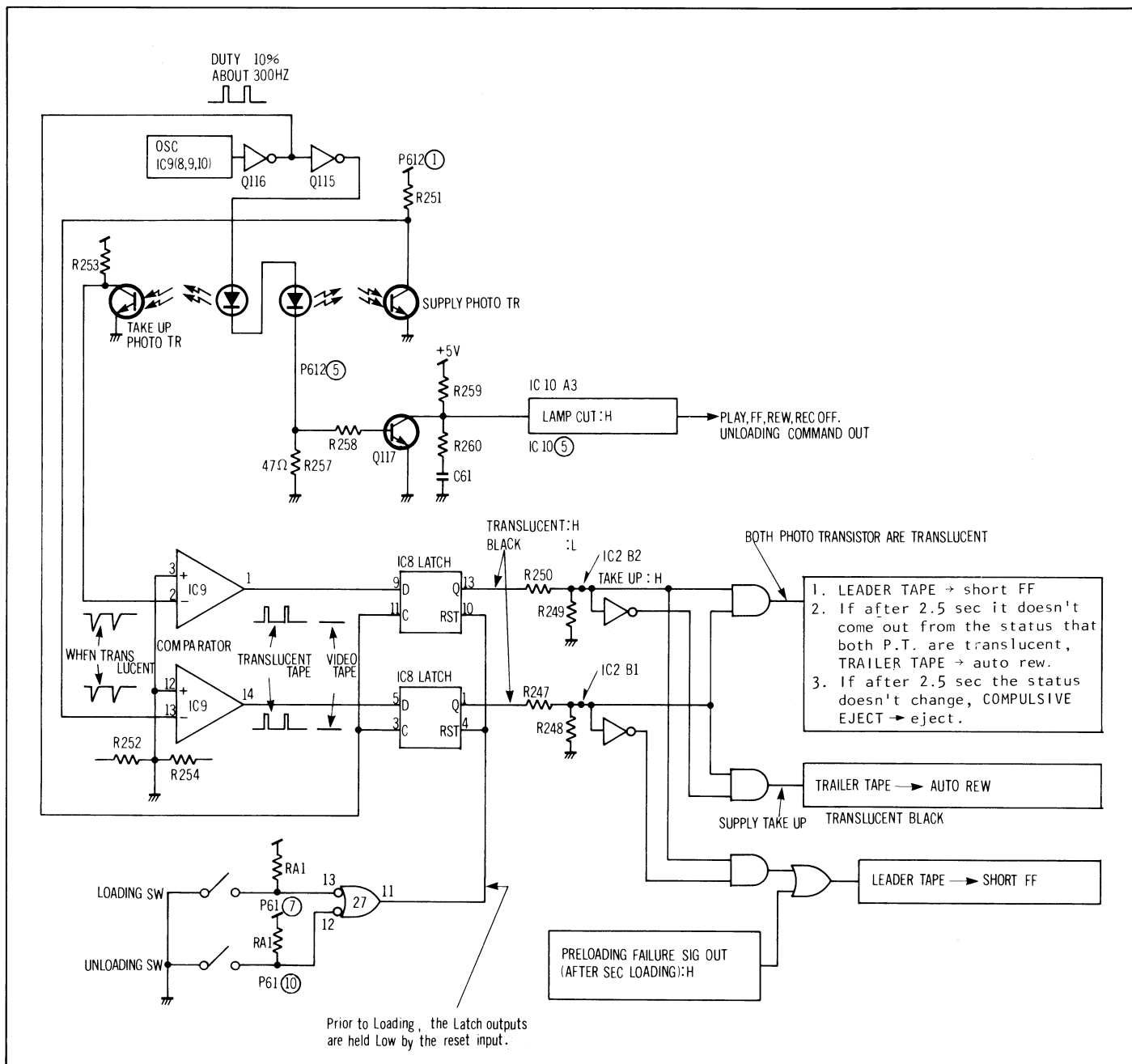


Figure 2-24

LED Lamp Sensor

Because the flashing LED is critical for tape protection, a lamp monitor circuit senses the forward current in the LED through R257. This forward current causes Q117 to pulse on and keep C61 discharged.

Should the LED fail, C61 charges and a high appears at IC10 (5), the A3 input, which will be multiplexed to the B port of the MPU. (See Figure 2-24)

Control Track (CTL) Input

CTL pulses are sent to the SNS1 input of the MPU (IC4 pin 59) from one of two pick up heads. These pulses occur at a 30 Hz rate, and are counted for tape time display. If the tape is subloaded (for FF or REW) Q122 and 123 amplify the output of the head located adjacent to the full erase head. If the tape is fully loaded (Play), the normal CTL head is amplified within the servo system, and part of that

signal is sent to Q121. The input to IC13, an opamp, is switched by IC27 and Q144 and 145, based on the state of the unloading switch, which is normally high and goes low at full loading completion. IC13 functions as a Schmitt trigger, and the output goes to IC4 (59) and the Remote control connector for use by the Edit Controller..via Q124. Q120 functions as an active power filter to reduce ripple and noise. See Figure 2-27.

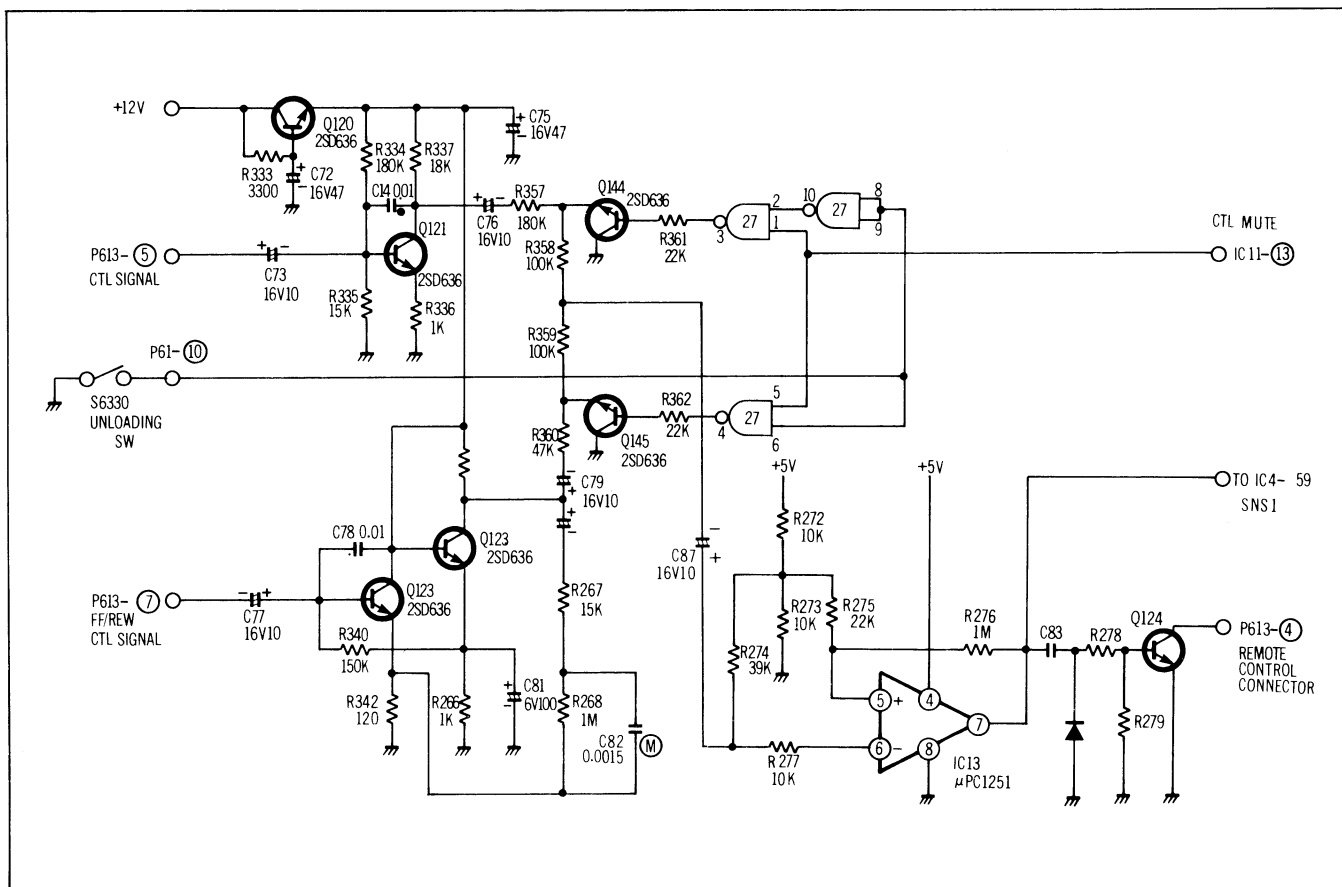


Figure 2-27

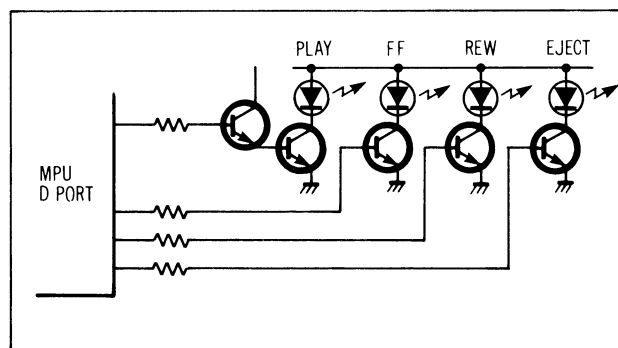


Figure 2-28

Outputs

The outputs from the output expanders or the MPU must be buffered prior to energizing their dedicated load. For example, the lamp (LED) drives for Play, East Forward Rewind and Eject use transistor buffer inverters which are driven by the D port of the processor, See Figure 2-28. The mode select solenoids function in the same way, using Port 6 of IC6.

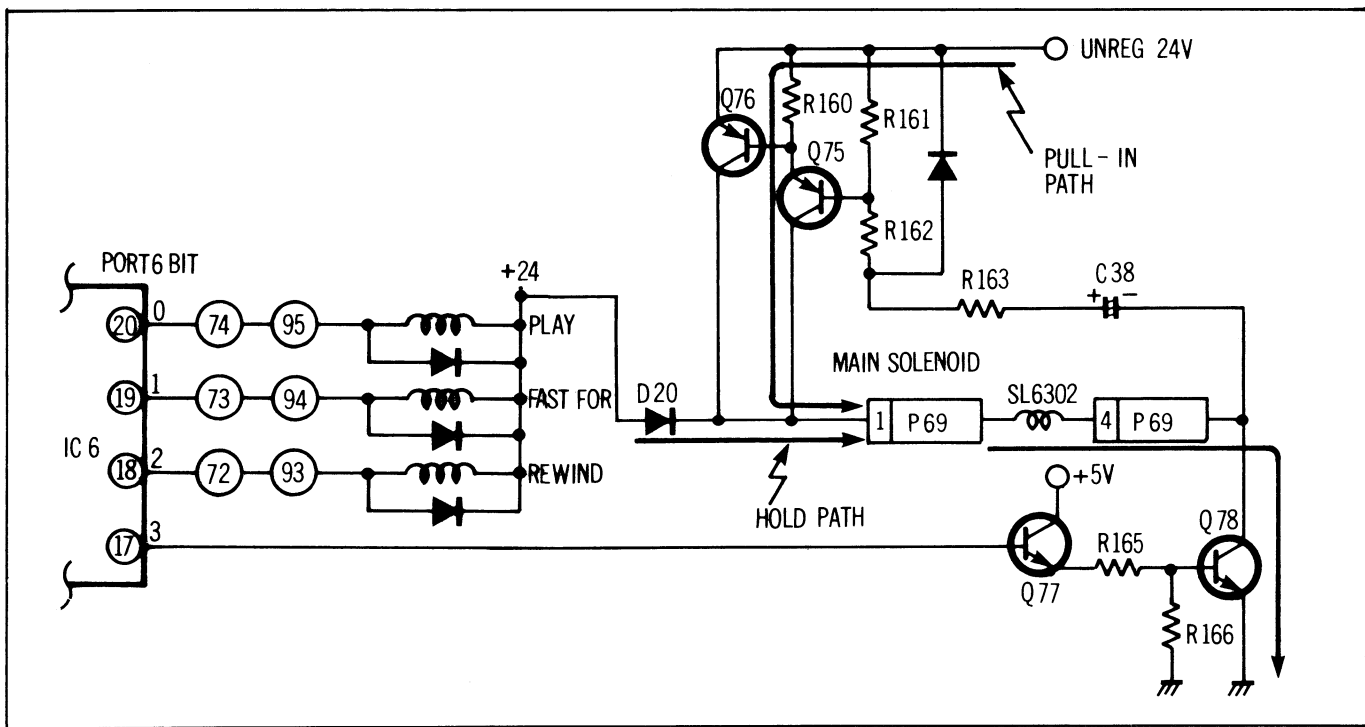


Figure 2-29

The main solenoid is slightly more complicated. For the main solenoid, Port 6 bit 3 goes high (IC6-17) and turns Q77 and Q78 on. If Q78 turns on, the collector of Q78 goes low, and C38 charge current momentarily turns on Q75, Q76. Therefore UNREG. 24 V energizes the main solenoid SL6302 through P69-1, P69-4, Q78 and ground. Refer to Fig. 2-29. When Q75, Q76 turn off, holding power is supplied through D20.

This same technique is used for the reverse brake band solenoid, which connects at P618, and uses Q140 through Q143. The outputs for the loading motor and the elevator are Port 5 of IC6, and are unique because the limit microswitches operate both directly and through the MPU. For example, the loading circuit is shown below (Figure 2-30).

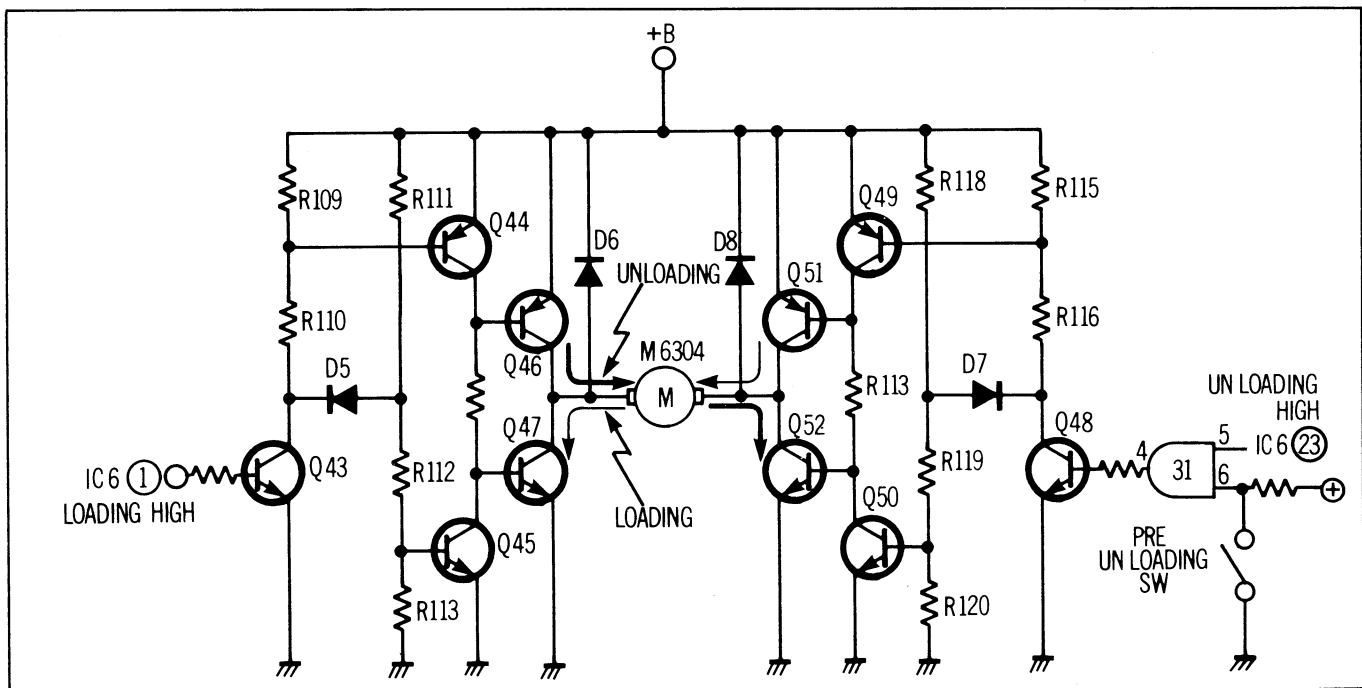


Figure 2-30

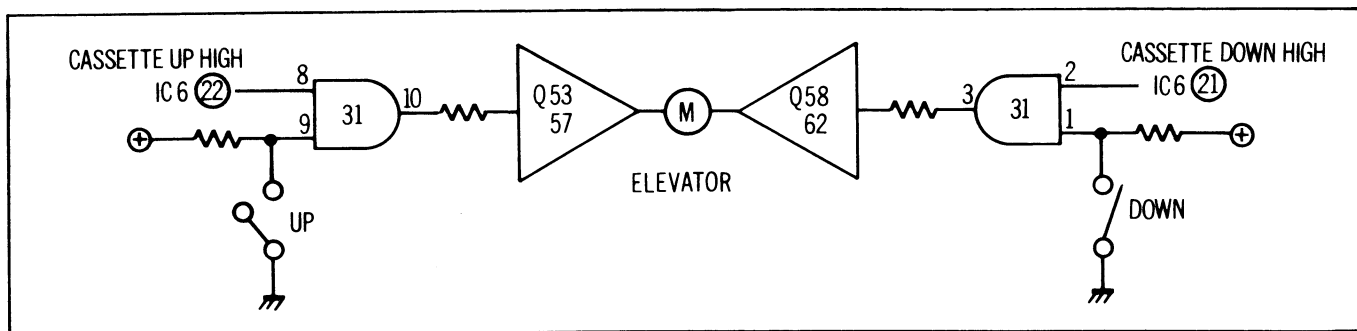


Figure 2-31

If the processor outputs a load command, IC6 pin 1 goes high, and if it is not already, pin 23 goes low. This turns on Q43, Q44 and Q47, which provide a ground return. 12 volt supply is available because Q48 is off (no high at IC31 pin 4), Q50 and Q51 are on. In this case the motor rotates until either the loading or unloading switch operate through MPU input multiplexer IC1, B2 and B3 to Port A, depending upon the machine mode (subload or full load).

For unloading, the process is reversed. The processor puts a low on IC6 pin 1 (Port 5 bit 0) and a high on pin 23 (Port 5 bit 1). Now Q45, Q46 supply +12 and Q48, Q49, and Q52 supply the return.

The motor runs in the opposite direction until the pre unloading switch closes, signifying unloading is complete, and this stops the motor by removing the high from Q48.

The elevator functions in exactly the same fashion, but there is a gate and limit switch in each side of the drive system. A different pair of drive circuits, Q53-62 are used, and the outputs come from IC6 port 5 bit 2 and 3. See Figure 2-31

Skew Motor Circuit

The skew motor moves an arm which sets the spring tension on the tension arm. This in turn controls tape back tension via the brake band on the supply reel table. Playback at a tension different than that during record causes a time error between the two edges of the video track, or a signal displacement at the head switching point. This displacement causes a bending at the top of the picture on the playback monitor. The front panel skew switch allows adjustment by the user. This switch signal goes to the MPU, which in turn drives the motor.

This may seem complex, but the skew is reset to normal every time the transport loads, and every time record is entered. It is not reset for editing, since the skew should be set to match the original program.

This circuit is very much like the Loading and Elevator circuits, except the switching is simpler and an electronic governor is used.

IC6 pin 4 is the Skew Up output, and turns on Q66, Q68 and Q91. IC6 pin 5 is the Skew Down command, and when it is high Q69, Q67 and Q92 are on. These are mutually exclusive states. See Fig. 2-32

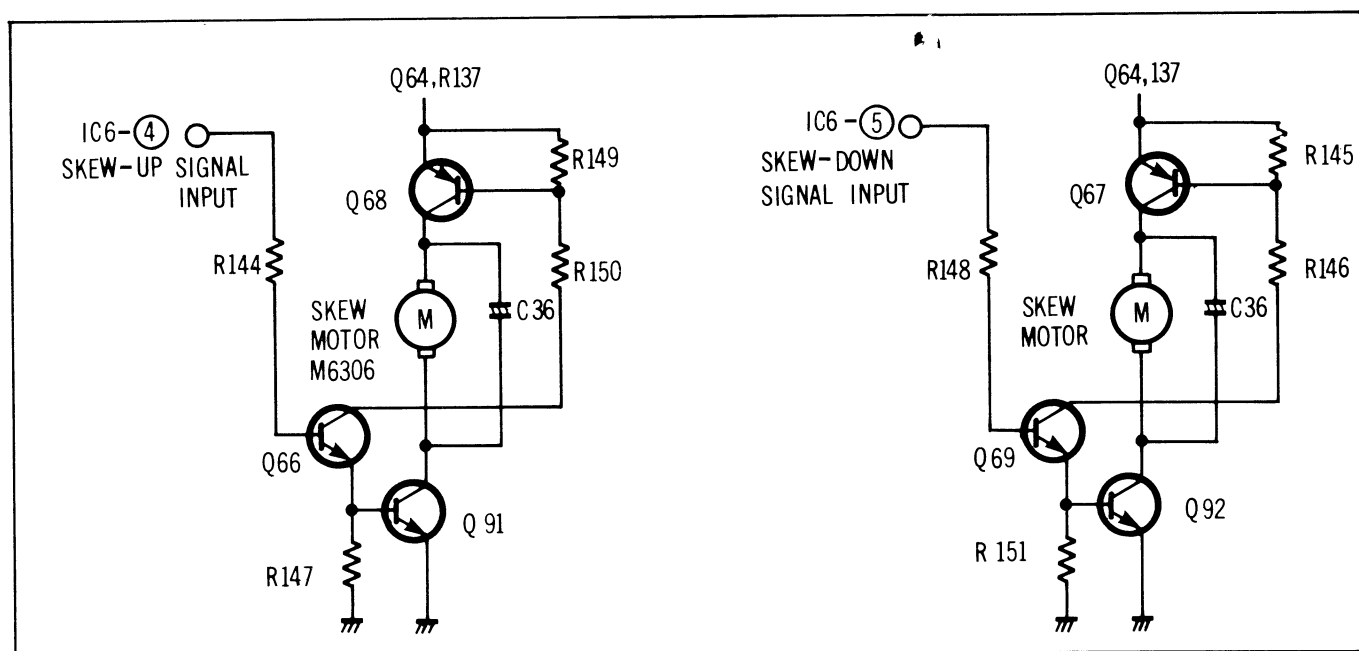


Figure 2-32

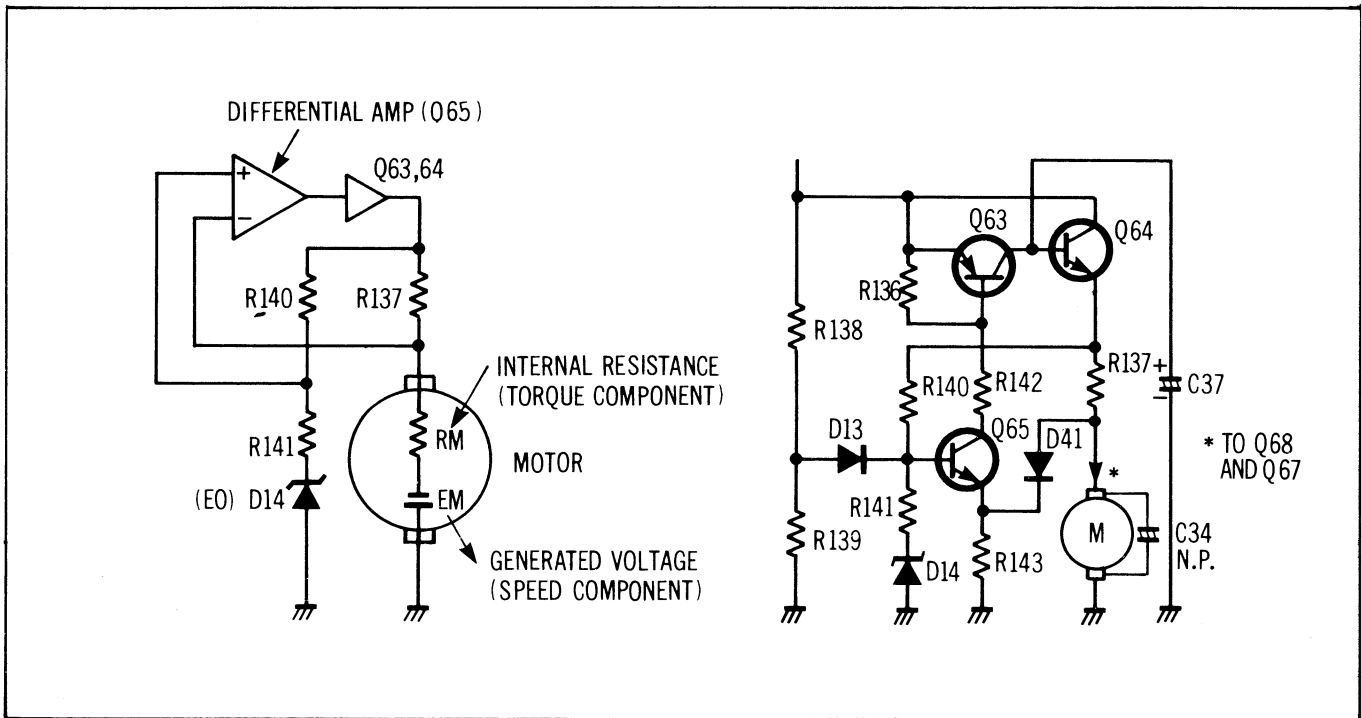


Figure 2-33

The power supply for both circuits is Q63, 64 and 65, which form a bridge type governor. R140, 141, D14, R137 and the motor make up a bridge circuit which is balanced when the motor speed is normal See Fig. 2-33

This bridge circuit has two stable modes: one is balanced, the other, all transistors are off. R138, 139 and D13 prohibit the second state. C36 and C37 are used to suppress noise and self-oscillation.

Skew Position

Two microswitches and a cam sense the position of the skew mechanism. One switch, the Skew "out of bounds" (OB) Switch (S6339) will close at either end of the permissible travel. The second switch, Skew upper, S6338, opens and closes at the midpoint of the travel. See Fig. 2-34

To stop the skew motor at the maximum of the upper boundary, the Skew Upper switch (S6338) is closed and the Skew OB switch (S6339) will be closed. To stop the motor at the minimum of the lower boundary, the Skew OB switch (S6338) is closed and the Skew Upper switch (S6339) is opened.

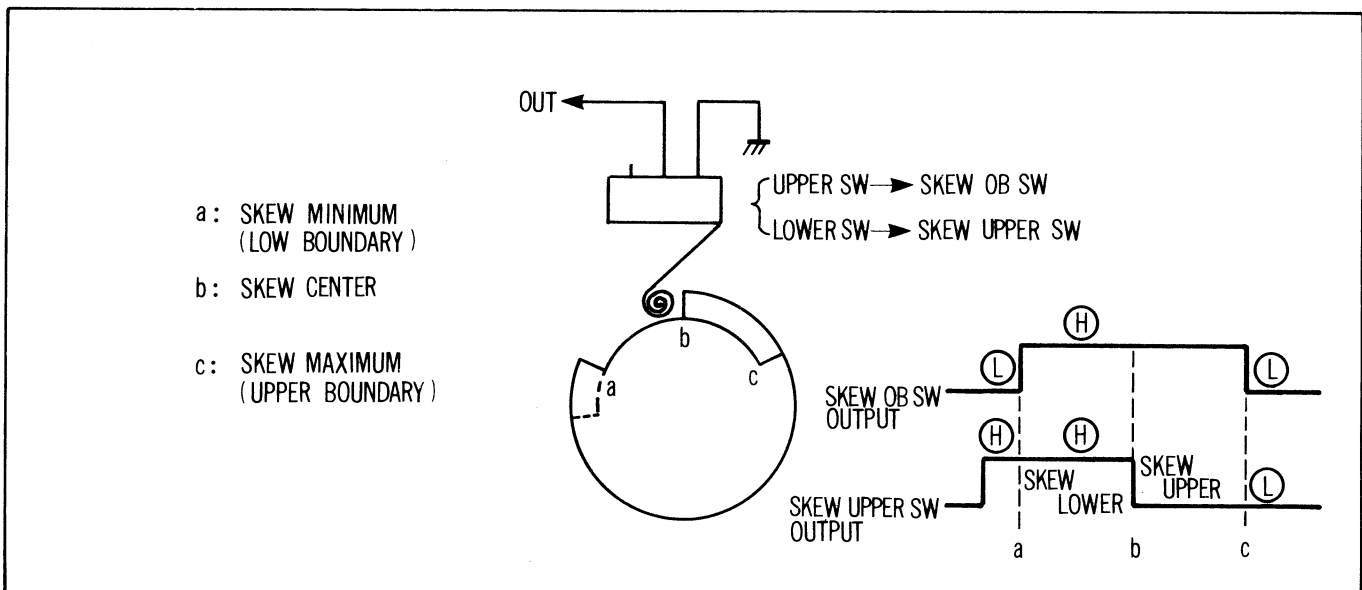


Figure 2-34

TAPE TIME DISPLAY

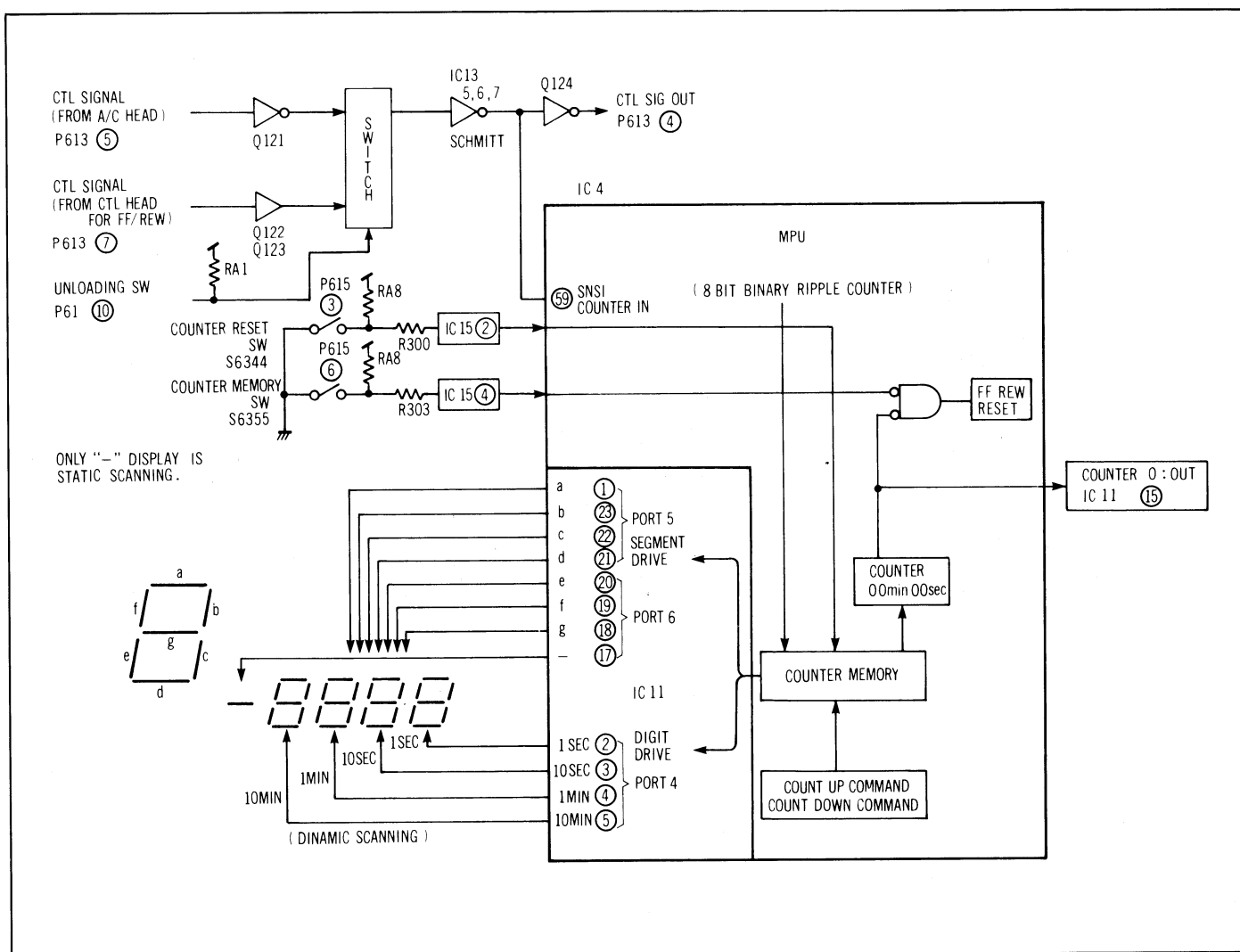


Figure 2-35

The tape time display is a five digit common-cathode seven segment LED indicator. The CTL control pulses, which come at 30 Hz in the playback X1 mode, are counted by the MPU, which indicates the digit for each segment by dynamic scanning for each place: 10 min, 1 min, 10 sec and 1 sec. Only the minus (-) display is static.

As shown in Fig. 2-35, the control signal is converted to a square wave by a Schmitt trigger circuit. The output square wave at IC13-(7) serves as the SNS1 input of IC4 and it starts to count the control signal. The MPU (IC4) contains an 8 bit binary ripple counter. The MPU also drives the segments and the digits, after data manipulation, through the output expander IC11. Note that the processor outputs segment on and off (1 and 0) data, not the actual numbers.

Counter Reset, S6344, functions to initiate reset of the counter memory inside IC4, and Counter Memory, S6355, enables stop at the 0000 position of the counter if it is detected during FF or Rew mode.

The MPU dumps in to IC11 Ports 4, 5 and 6 output signals in accordance with the segments required to be displayed. Q129-Q136 drive the segments and Q125-Q128 drive the cathodes for the four digits. (See Figure 2-36)

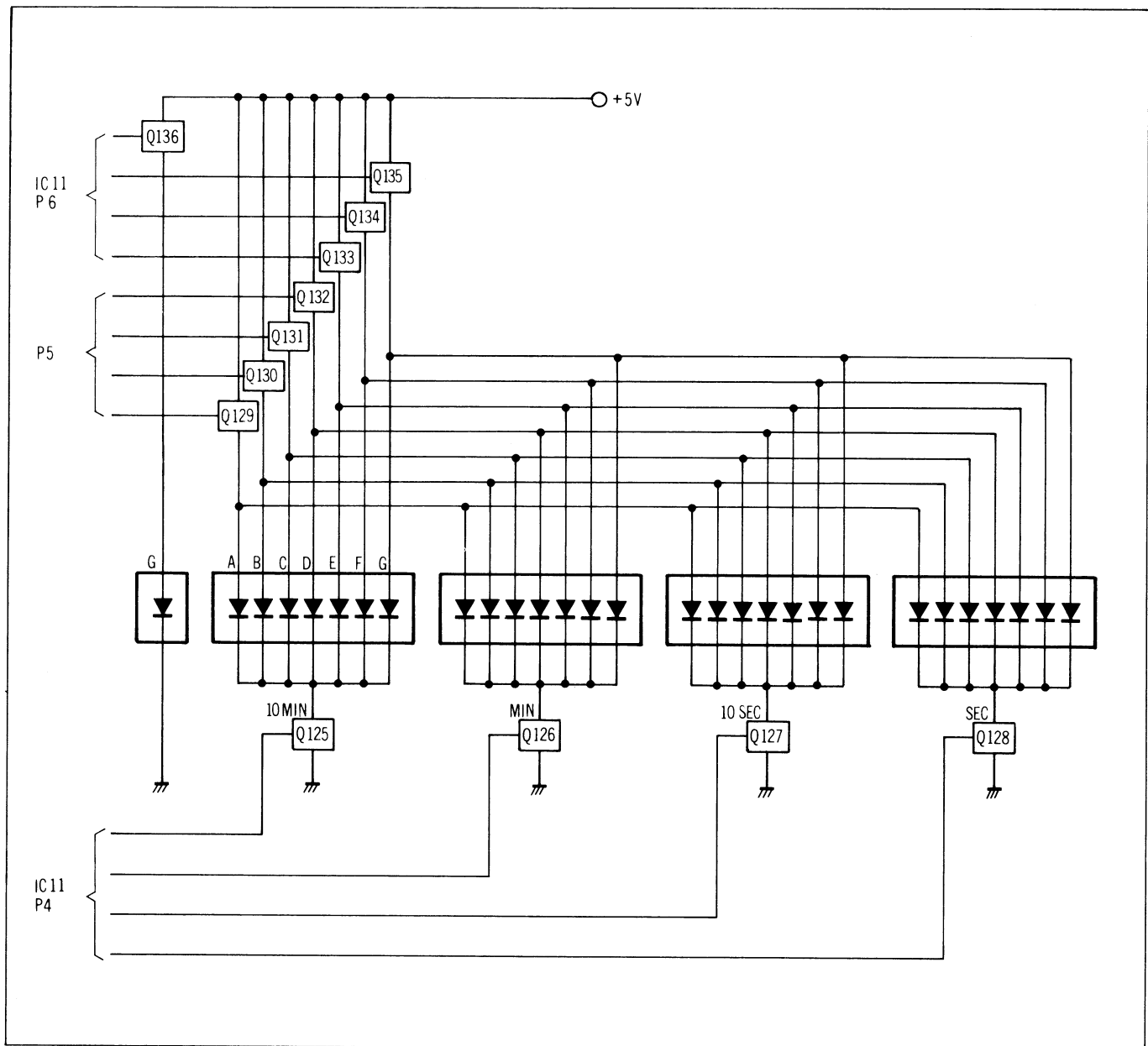


Figure 2-36

Warning Lamp

The warning lamp is lit if the dew sensor operates, and the lamp is flashed if the LED sense in the photo transistor circuit fails or if unloading is stranded due to tape slack or some other internal problem. See the figurative block diagram in Fig. 2-37

Allied Transport Circuits

Also within the Transport Control circuit are several groups of circuitry which are enabled by the MPU but independently generate outputs due to the critical nature of the timing required.

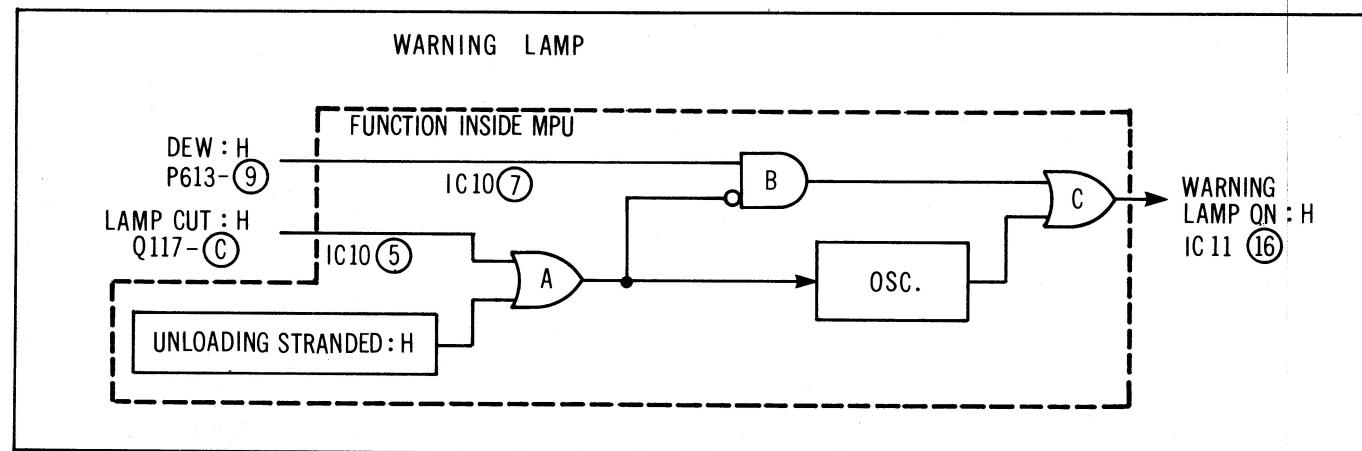


Figure 2-37

Video Editing

In Assemble editing, where the beginning of new material is joined to that which was previously recorded; and in Insert editing, where a segment within a previously recorded program is to be replaced with new, a clean transition from old to new is required. In order to accomplish this, precise control of the turn on and turn off of the video record function is required. In addition, the video head drum has two additional heads to erase the previous video track so that new information may be recorded. These too must be turned on and off at the correct moment, which is different from video record, due to their angular displacement on the cylinder.

The timing control circuits are required for the "Cut In" and "Cut Out" timing during the insert mode and at start of editing during the Assembly mode because the switching from the prerecorded segment to the new video must occur during the vertical blanking interval. They also control the timing for erase current and time code jump timing.

During the Insert mode, the previously recorded video is erased by the rotary erase heads. During the Assembly mode both the rotary erase heads and the full erase head are energized, simultaneously. In the Assembly mode, the rotary erase heads are energized as in insert editing, but for only about 5 seconds after the start of editing, in order to erase the segment of the tape which had already passed by the full erase head prior to the entry of record. The rotary erase heads are physically mounted about 60 degrees ahead of the video heads, as shown in Fig. 2-38.

Since the rotary erase heads contact the tape 60 degrees ahead of the video heads, but are offset on the cylinder, they appear to lag by 11.87 MS or 120°. Therefore, they are switched on and off slightly ahead of the video head switching time. The switching point of both the flying erase and the video record head occurs at the same position on the prerecorded video track.

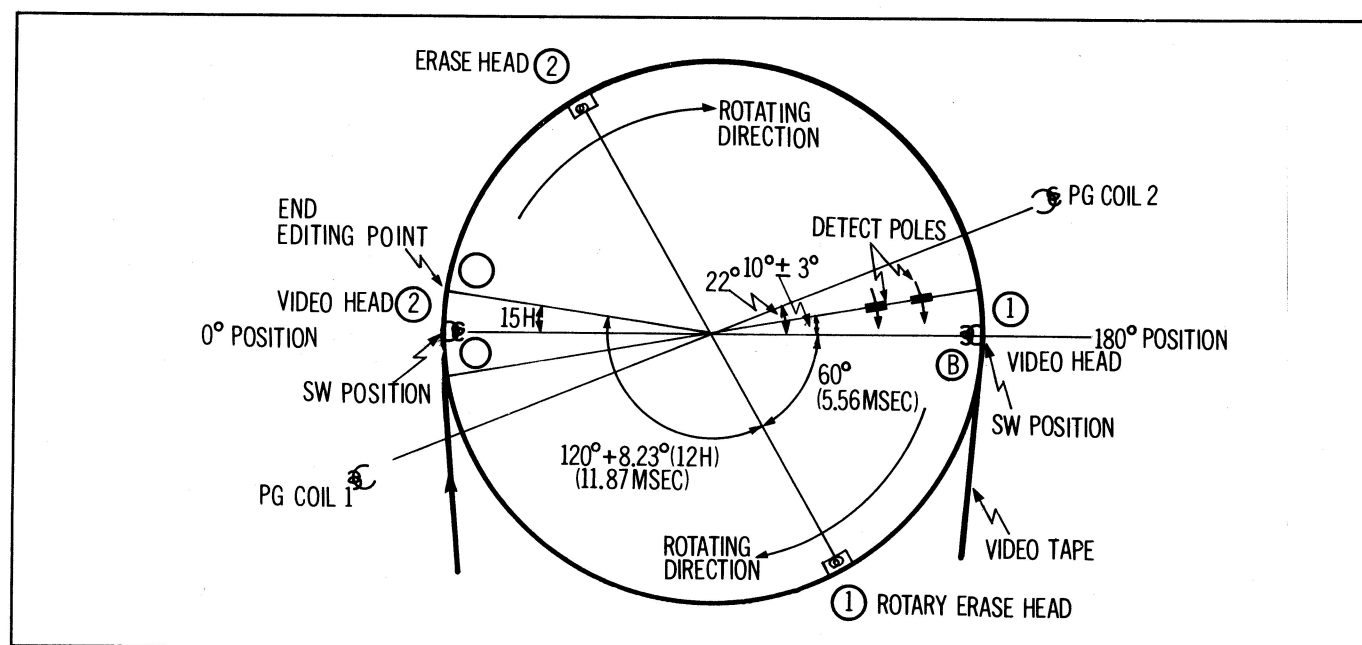


Figure 2-38

Flying Erase Memory

Since Flying erase must begin and end at a critical time, a Flying Erase memory Flip Flop is set and reset to turn the erase on and off. Due the angular offset described above, turn on (set) is delayed by 11.27 MS, which equals 120 degrees of head travel, from the head switching point. IC16 and Q30 form the delay element, and the output of IC16-1

is differentiated by C22 and R82 to form a set pulse that is gated with Flying Erase (H) from the MPU (IC7-5). When this point goes low (Flying erase off) the same delay obtains. See Figure 2-39

Video E-E can also reset the flip flop without delay through C22 and R80, from the MPU via IC7-4.

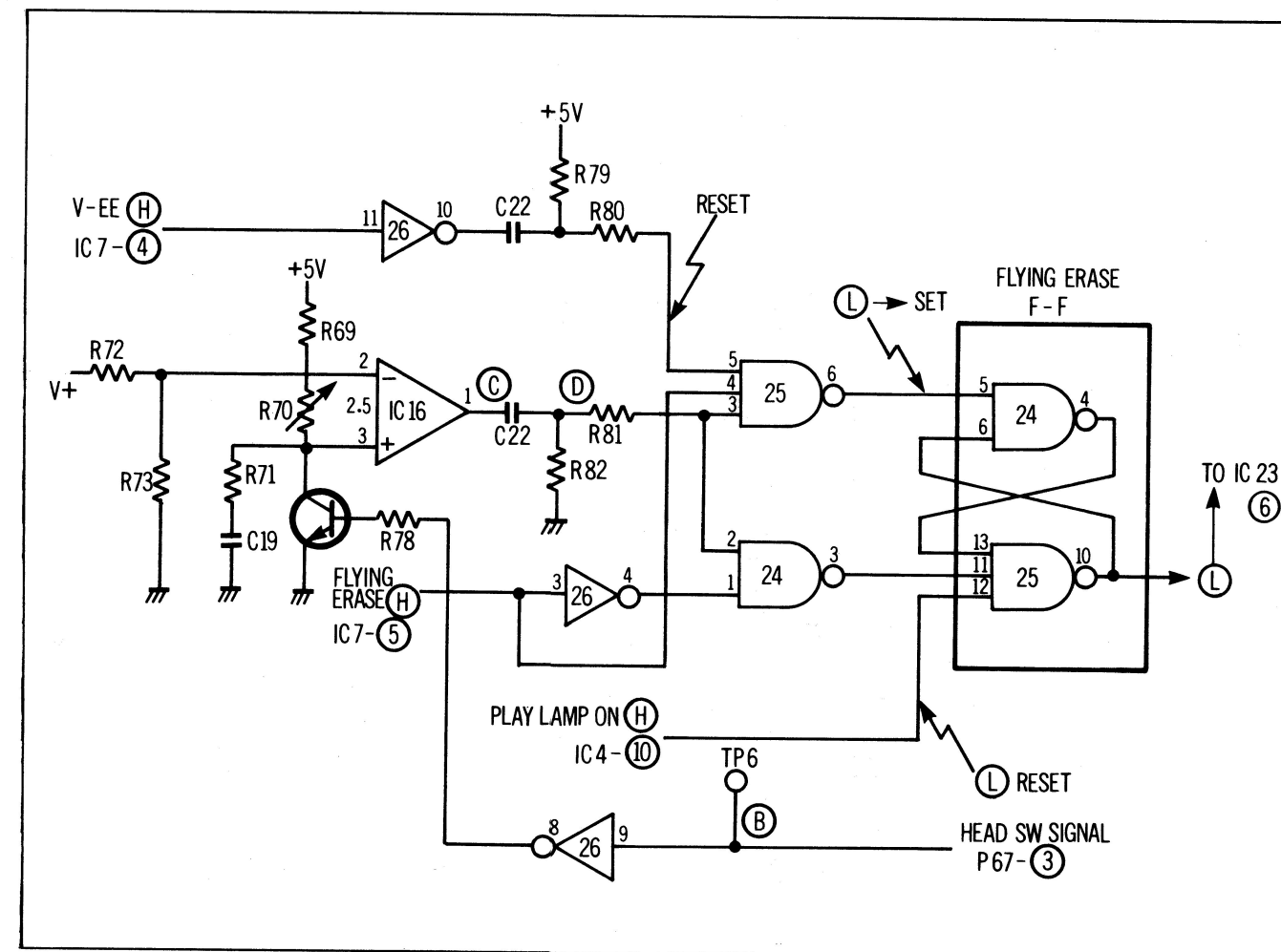


Figure 2-39

Video Record Memory

IC25 and IC23 form a record memory flip flop used for turn on and turn off of video record, triggered by the head switching signal. This flip flop is inhibited during E-E because the output is gated with the MPU (IC7-4) for logic control (IC23-11, 12, 13). The head switching signal is inverted by IC26-8, 9, and is differentiated by C33 and R84. This pulse sets the record memory through IC24 (11, 12, 13). IC24 (13) comes from IC23 (4, 5, 6), Flying Erase on

and Video Record. Therefore, video record starts when video record, flying erase, and head switching all act. See Figure 2-40.

Reset of this record memory flip flop turns off video record, based on the 5H delay of IC17 (2, 3, 5). This delay is triggered by head switching and gated with inverted (IC26-1, 2) IC23 (4, 5, 6), Flying Erase and Video Record. This generates a reset pulse through C25 and R87.

See Figure 2-43, the Record/Erase timing chart.

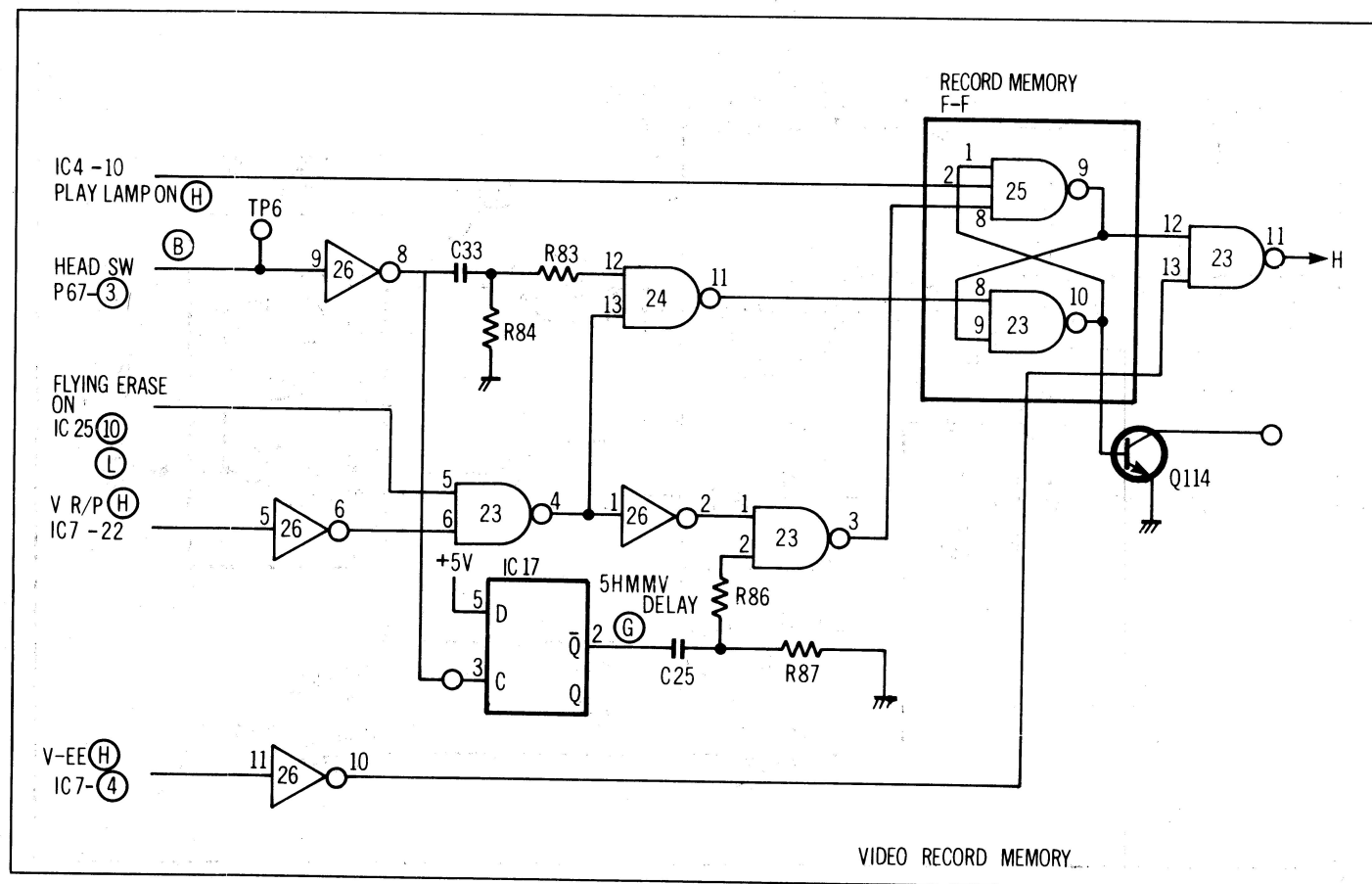


Figure 2-40

Flying Erase Oscillator

The output of the flying erase memory IC25-(10) turns off Q96 to enable the 4.7 MHz oscillator Q97. This signal is buffered by Q103 and sent to two drivers, Q99 and Q105, for two separate output stages. One is Q100, Q101, Q102, and the other is Q106, Q107, Q108.

Prior to Q99 and Q105 are two switching transistors, Q98 and Q104. These turn on to inhibit the output of the flying erase when the head for that output is over the time code address track.

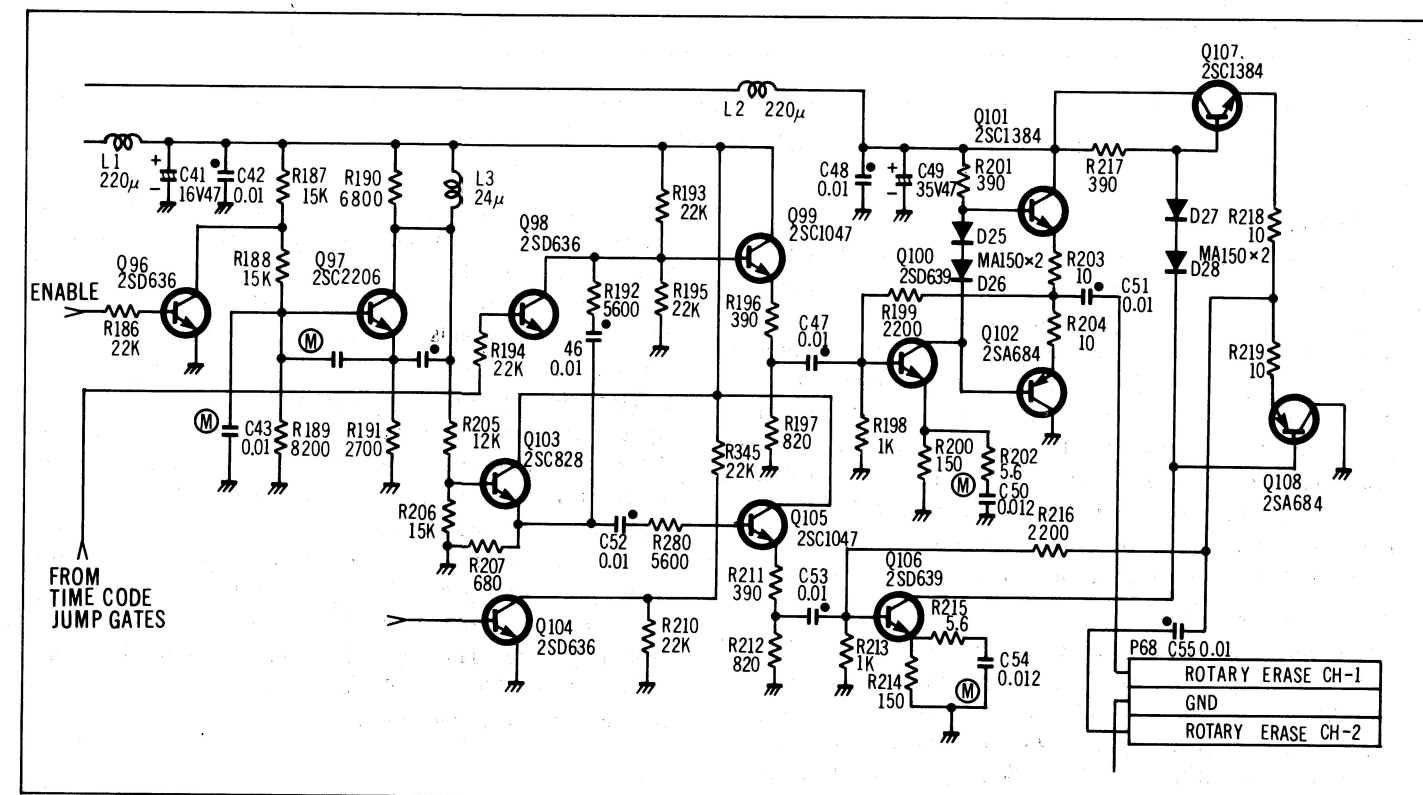


Figure 2-41

Time Code Jump.

The time code jump circuit is enabled by the signal from the T.C. Address/Audio 1 switch S6303 on the rear panel. If the T.C. address track is chosen, +12 appears at P615-10, and diode D39 is off. If no +12 is applied, D39 conducts through R307 to inhibit the jump circuit.

The head switching pulse is differentiated by C95 and passed by D43 to Q31, which turns on to discharge C20. C20 then begins to charge until its level exceeds that of the reference made by R72, 73, and then the output of IC16-(7) goes high. This triggers IC17-(11), a D type flip flop which forms a MMV. When the Q output IC17-(13) goes high, since the D input (9) is held high, reset occurs after C18 charges.

This makes the pulse. Since both phases of head switching must have erase jump, inverted head switching from IC26-(8) triggers IC17-(3) for another purpose (record overlap) but the Q output, which goes high, also triggers Q31 through R370, and the same process occurs. (See Fig. 2-42).

The output pulse from IC17 is NOR gated with the time code low (lamp signal) so the jump signal is inhibited unless there is time code present, and with the head switching signal so only the proper erase head is disabled by the outputs, which go to Q98 and Q105.

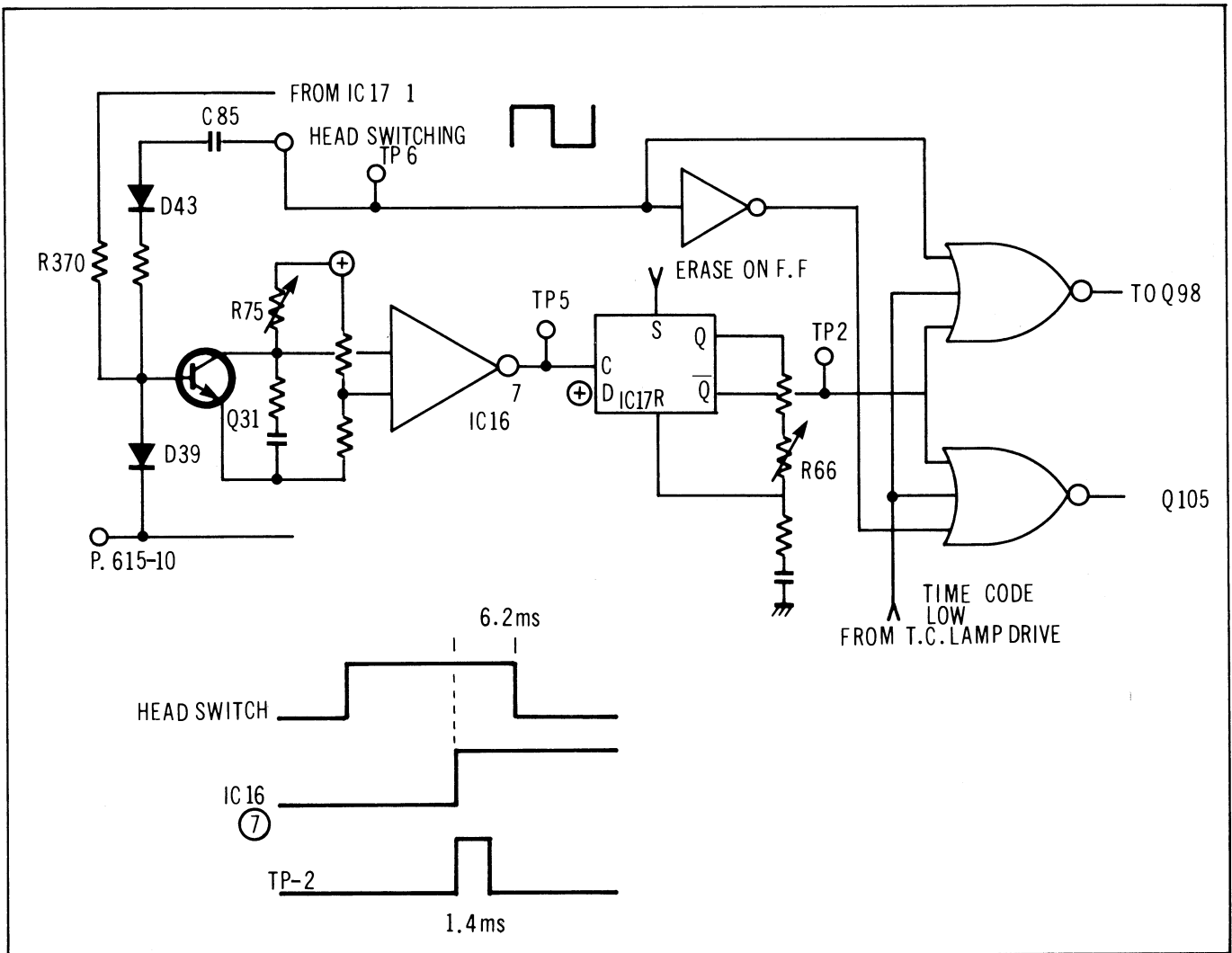


Figure 2-42

Main Erase

The full erase head is driven by the main erase oscillator Q34, Q35 Q36 and T1. This is controlled by the MPU from IC7, 21 (Port 5 bit 3) through IC29 and Q33. This is the same command as CTL record.

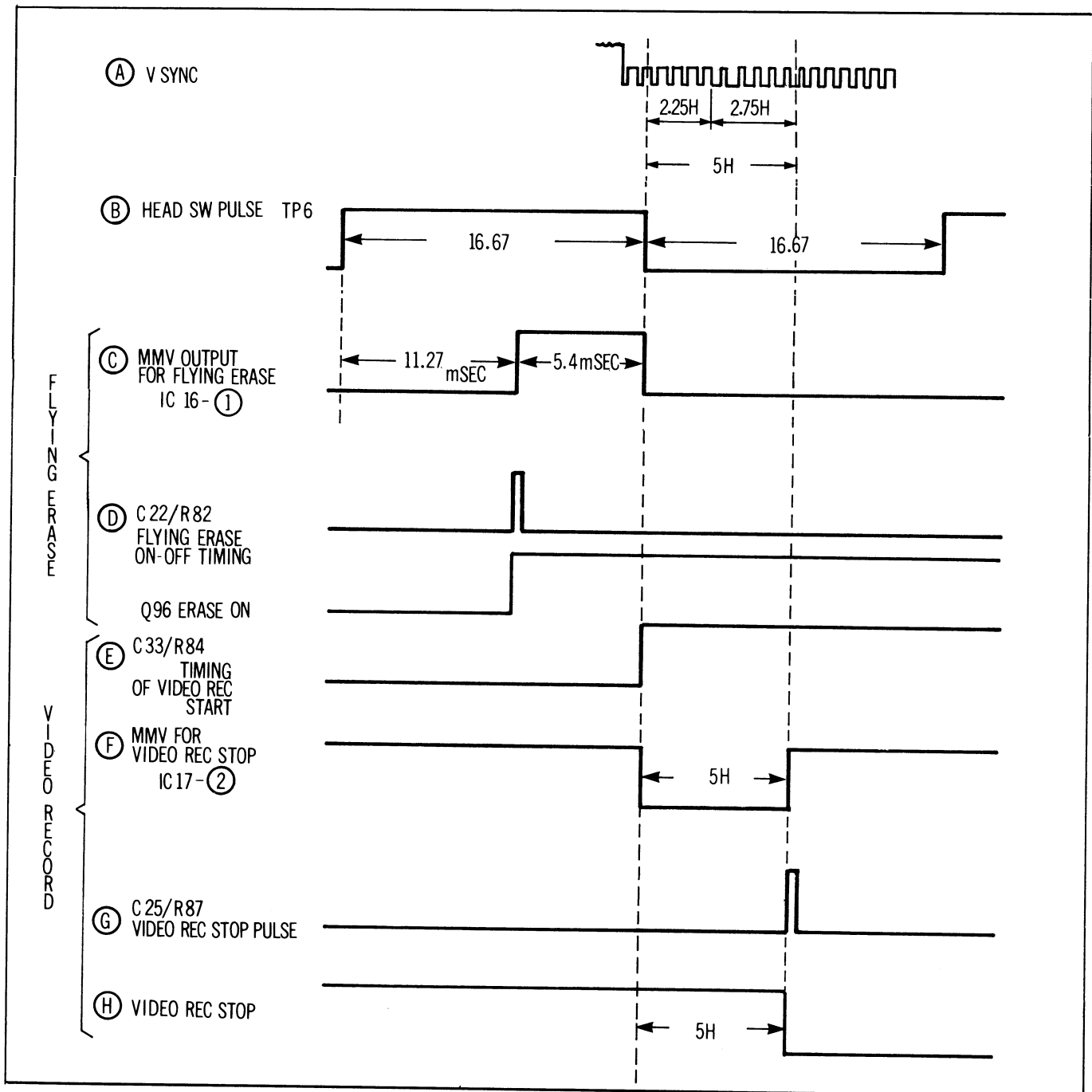


Figure 2-43

Note

In the following section, various portions of the Transport Control Circuit microprocessor and memory are represented as conventional logic elements. This is done to portray the interrelationship between inputs, outputs and the program of the processor. The processor is drawn as a mode memory element (flip flop) with set, reset and output.

All those events and signals which can initiate the mode are set inputs; all those which can stop or inhibit the mode are reset inputs. The outputs are shown without regard to sequence of operation.

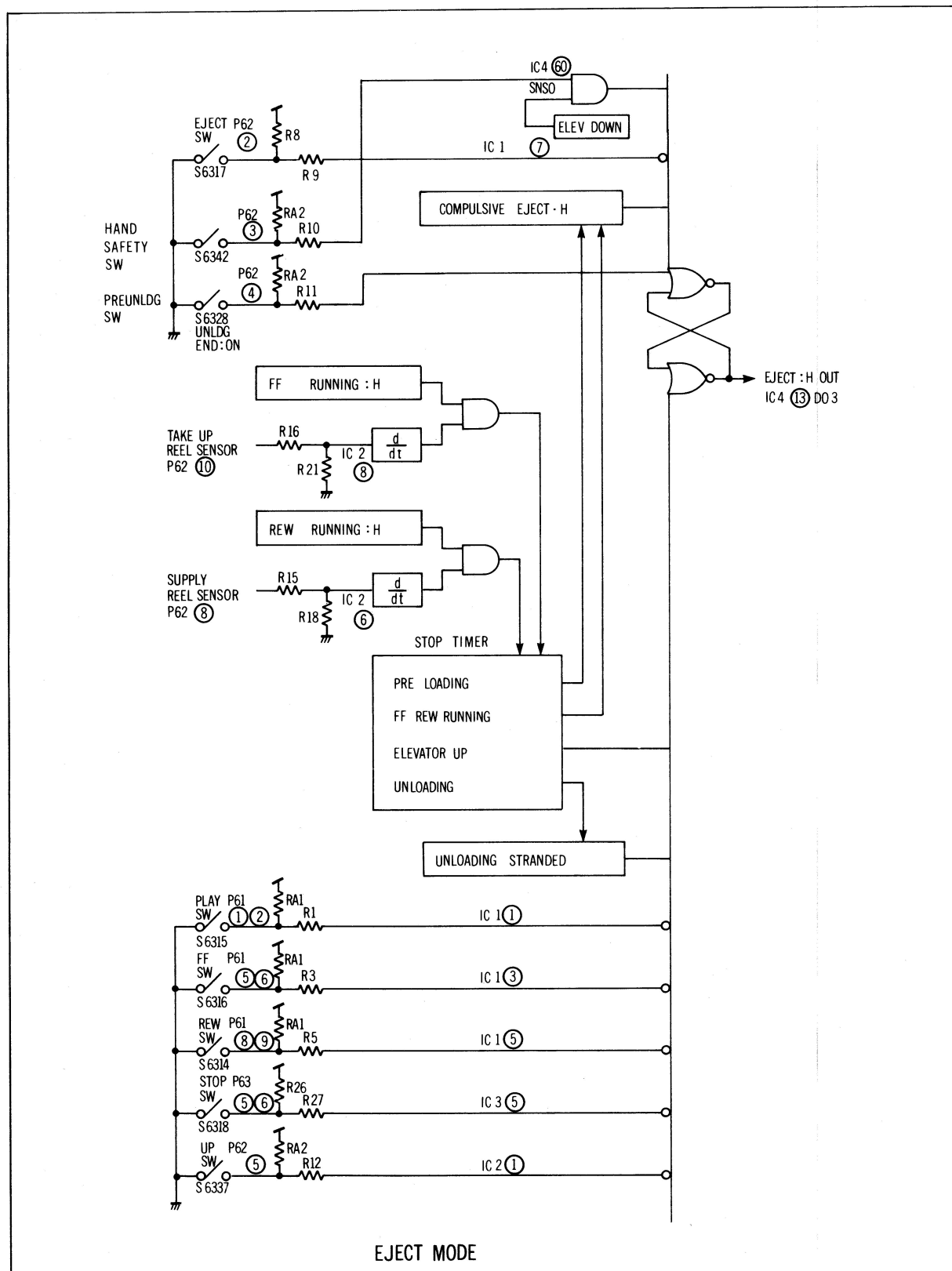


Figure 2-44

Eject Mode

Eject start (set)

The Eject mode can be started by the Eject button, the hand safety switch (while the elevator is in the "drive down" mode), or the conclusion of unloading (Pre unloading switch). In addition, if the reel turntable which is being driven by the reel motor (FF or REW) does not turn for 10 seconds, a timer starts the eject process.

If preloading can not be accomplished at the start of the FF or REW modes, the processor waits 5 seconds, then attempts preloading again. If it is still unable to load, Eject is begun.

Eject cancel (reset)

Initiation of any other mode-Play, F.F, Rew, Stop halts the eject process.

If the elevator cannot be raised in about 10 seconds, eject is halted and subloading is performed.

If unloading can not be performed after eject is initiated, the eject mode is reset and the warning lamp flashes after 20 or 30 seconds (Unloading Stranded).

Play Mode:

Only the play switch initiates (sets) the Play mode.

Play mode will stop if any other mode is initiated (FF, Rew, Stop, Eject). Play will continue only until the cassette elevator has been lowered if no cassette is in place. If a cassette is not fully in position, the play mode is inhibited. If the Dew detector or LED sensor (Lamp Cut) operate play will be inhibited or halted.

The hand safety switch will reset play until loading begins.

The stop timer has several conditions for operation.

If the reels stop during X5, X2, normal, X1/5 or X1/20 mode, a counter inside the MPU starts to count down for a time period from 3 seconds to 15 seconds, respectively.

During the pause mode, a reset pulse appears 9 minutes after pause for tape protection.

If unloading, loading or elevator jam, a reset pulse is generated after 10 ~ 15 seconds.

If the cylinder motor is stalled, a high appears at P62-(7) resetting the play mode.

If the tape safety switch S6341 opens during playback, the play memory is reset after 2 seconds.

If the Supply and Take-up photo transistor sense the tape beginning or end, the play memory is reset.

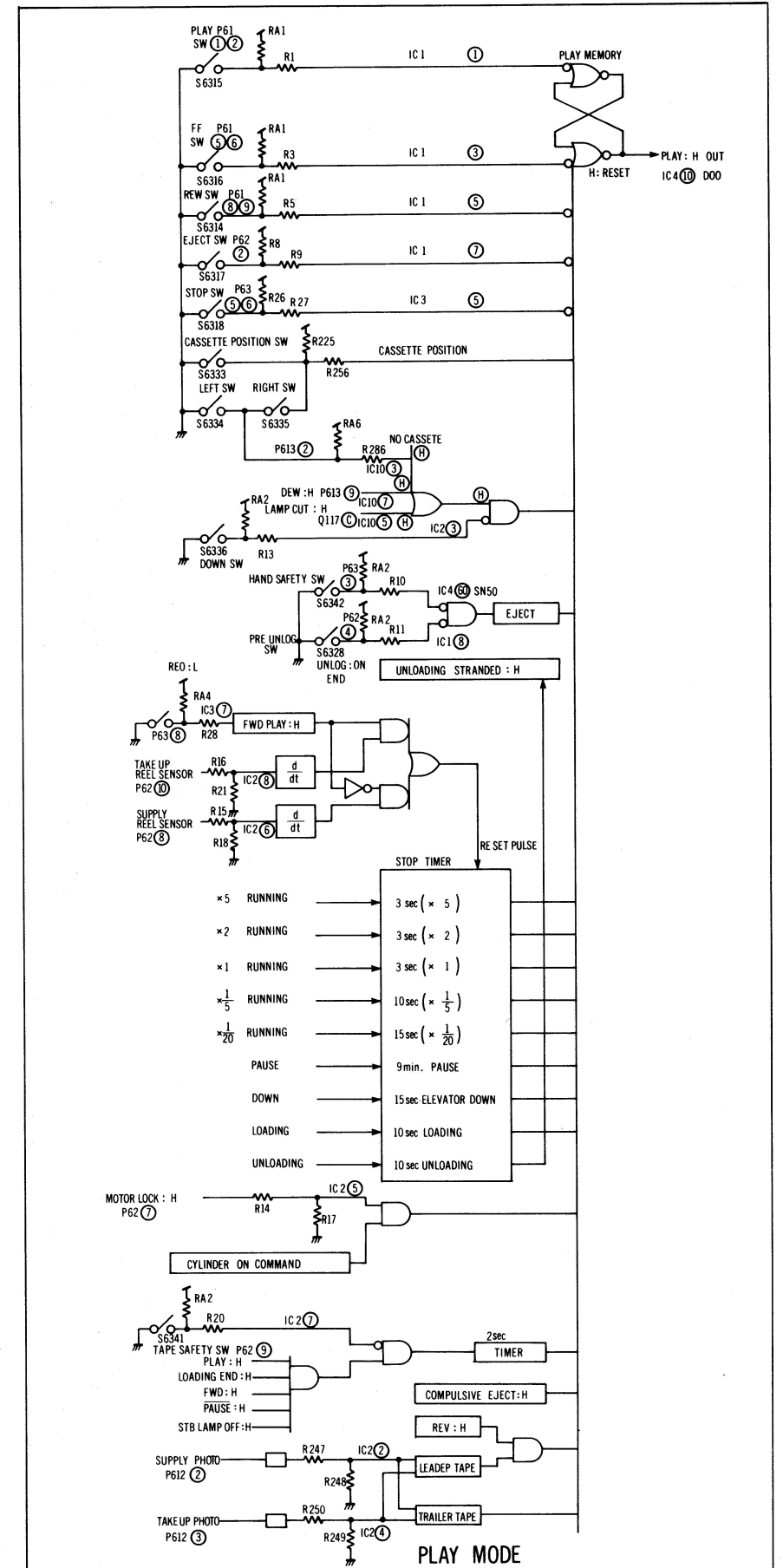
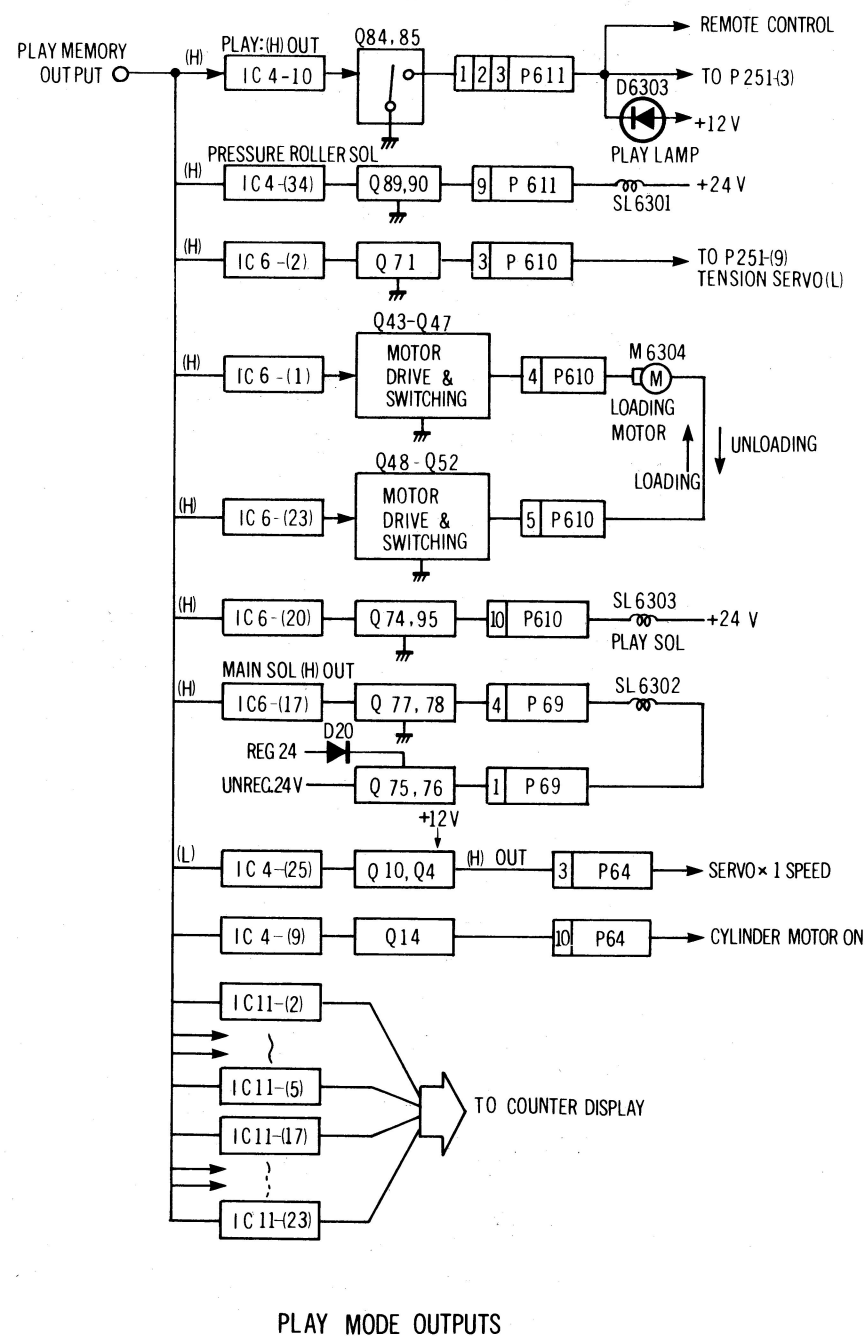


Figure 2-45

Play Mode Outputs

When the play mode is started, the MPU generates the outputs represented below.



PLAY MODE OUTPUTS

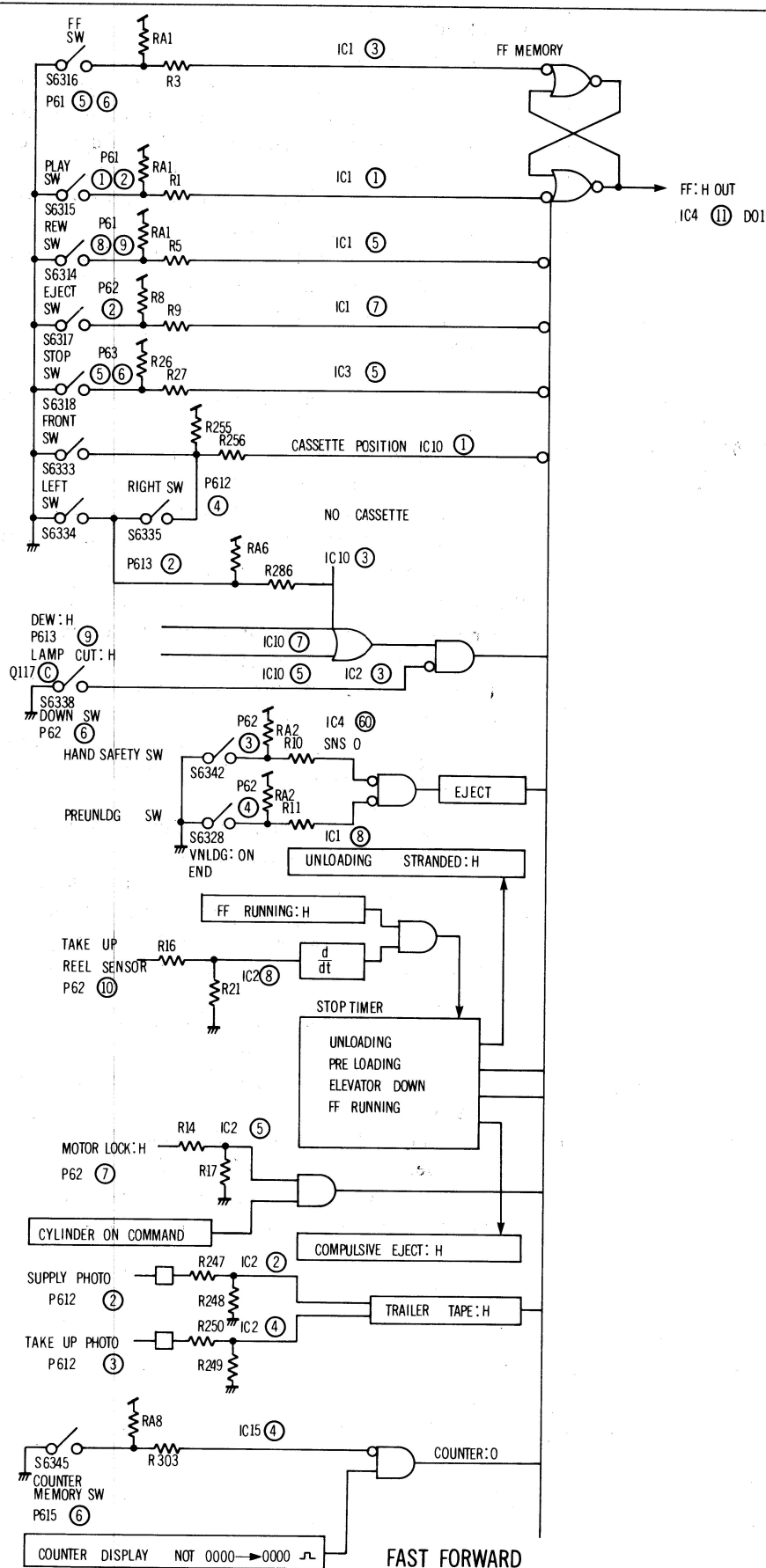


Figure 2-46

Fast Forward Mode

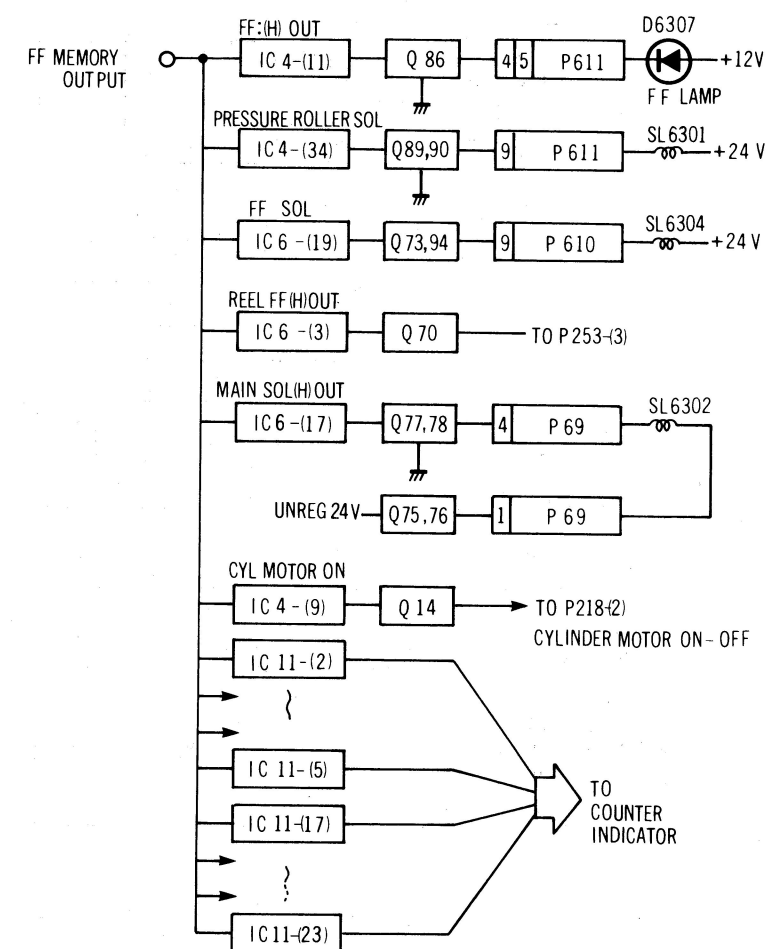
Only the Fast Forward switch initiates (sets) the FF mode. The initiation of any other mode (Play, Rew, Eject, Stop) stops or resets the FF memory.

The Cylinder Stalled, Dew Sensor, Sensor Lamp Cut, the Hand Safety Switch, Unloading Stranded, and the Stop Timer circuits all function as in Play mode, except if the reel table stops during FF, the MPU counts 10 seconds and then resets the FF memory (See Eject operation).

When the end of tape is detected by the Supply and Take-up photo transistor during FF mode, the FF memory is reset.

When the counter memory switch S6345 is on (memory position) and the counter reaches "0000", a high generated inside the microcomputer resets the FF memory.

The outputs are much the same as those for Play.



FAST FORWARD OUTPUTS

Figure 2-47

Rewind

The rewind mode functions in the same fashion as Fast Forward.

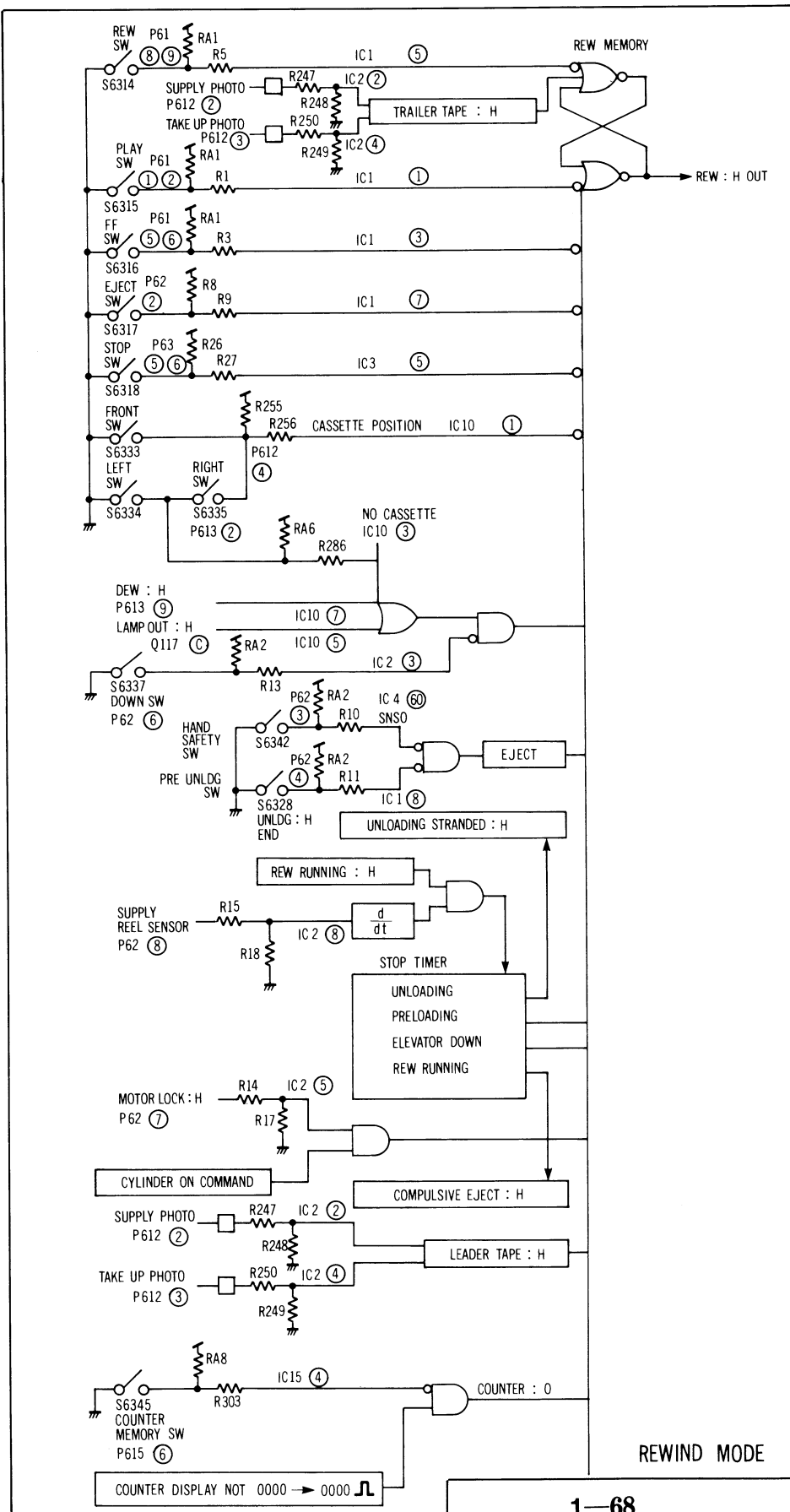


Figure 2-48

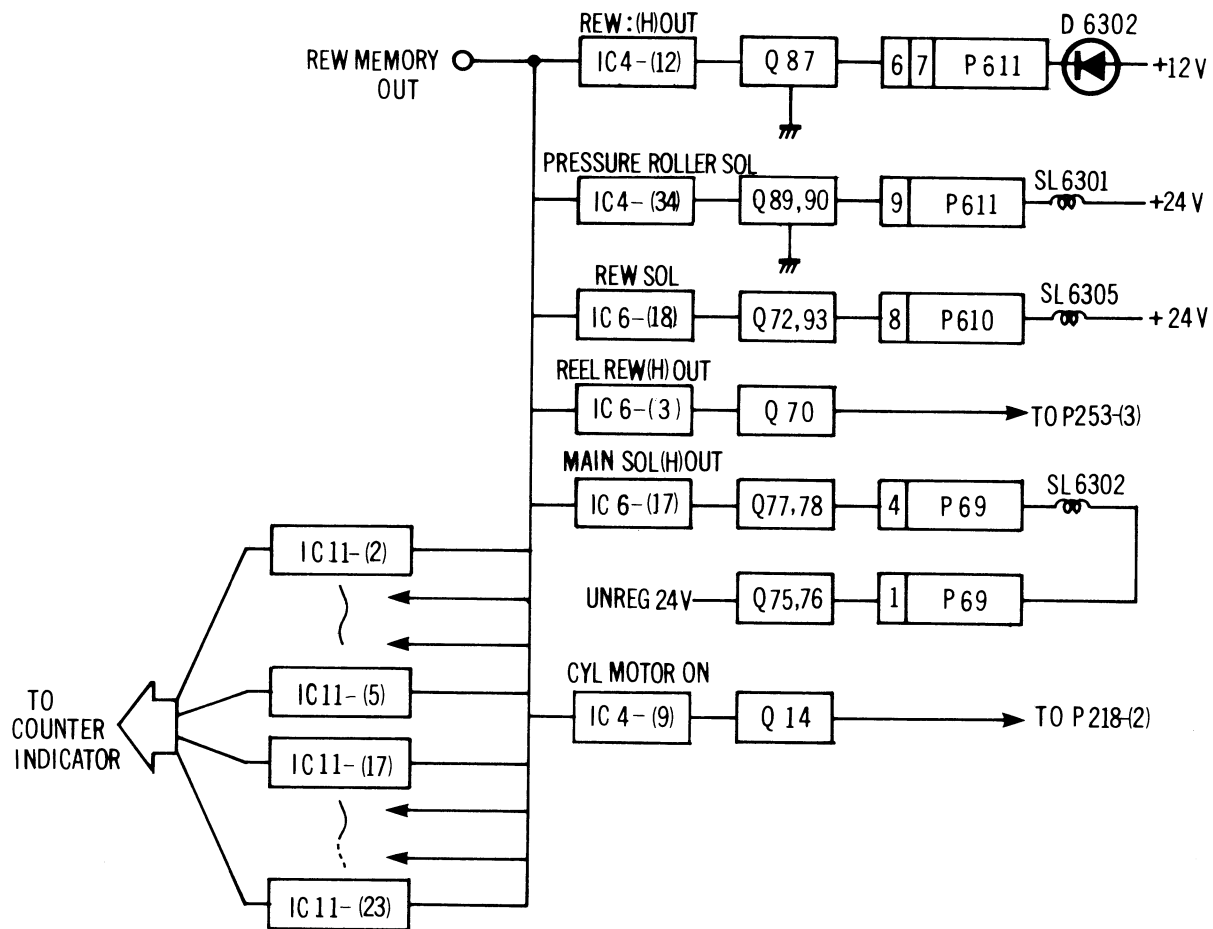


Figure 2-49

Record Mode

The unit is set into the Record mode through the Record switch (S6322). To set the Record memory, the unit must not be in either the Play mode or Editing mode. However, the Record memory can be set during the pause mode.

The Record memory is reset by the initiation of the fast Forward, Rewind or Eject modes.

During the X1/20, X1/5, X2, X5 or Reverse mode, the Record memory is inhibited.

When the Cut Out switch (SW S6319) is pressed, the Record memory is reset.

The Record Inhibit switch (S6336) will open if the red button is removed from the large hole in the bottom of the cassette case. This will inhibit Record Set. If a Play memory reset signal appears, the Record memory will also be reset.

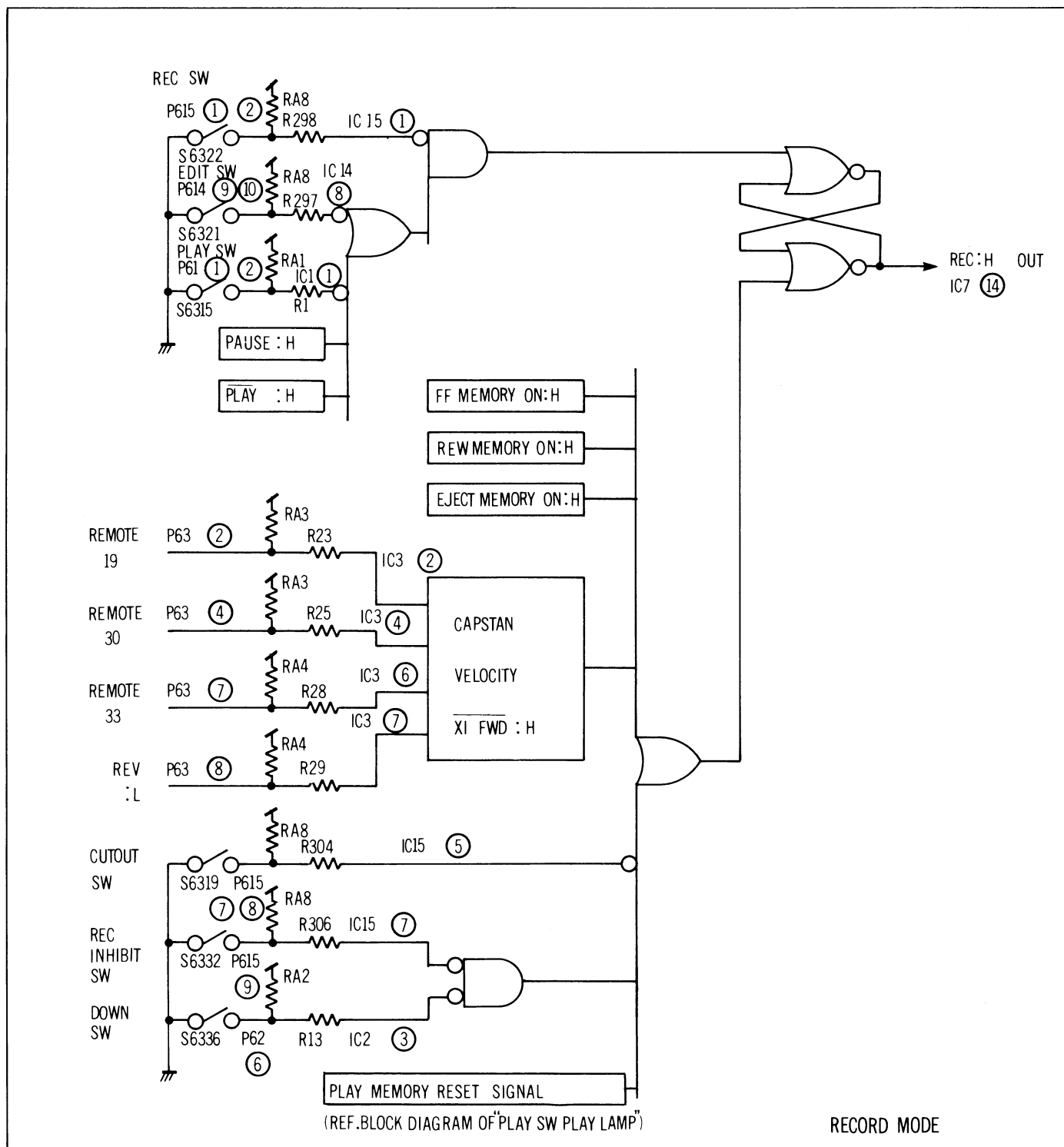


Figure 2-50

Record Memory Output

The Record Memory lights the Record lamp, places the mechanism in the Play mode, and generates the outputs shown below.

In the Record mode, a high appears at IC7-1 which turns Q41, Q42 on resulting in Audio CH1 R/P 12 V output at P67-7, and a high appears at IC7-23 which turns Q40, Q138 on resulting in Audio CH2 R/P 12 V outputs at P67-8.

Additionally, a high appears at IC7-22 which turns Q37 off, and Q38, Q39 on, which results in Rec 24 V outputs at P67-9, 10. In this circuit, a 10 msec delay circuit (C31, R96) is used to prevent audio pop noise.

Actual video Record is controlled by the Record Memory FF described above.

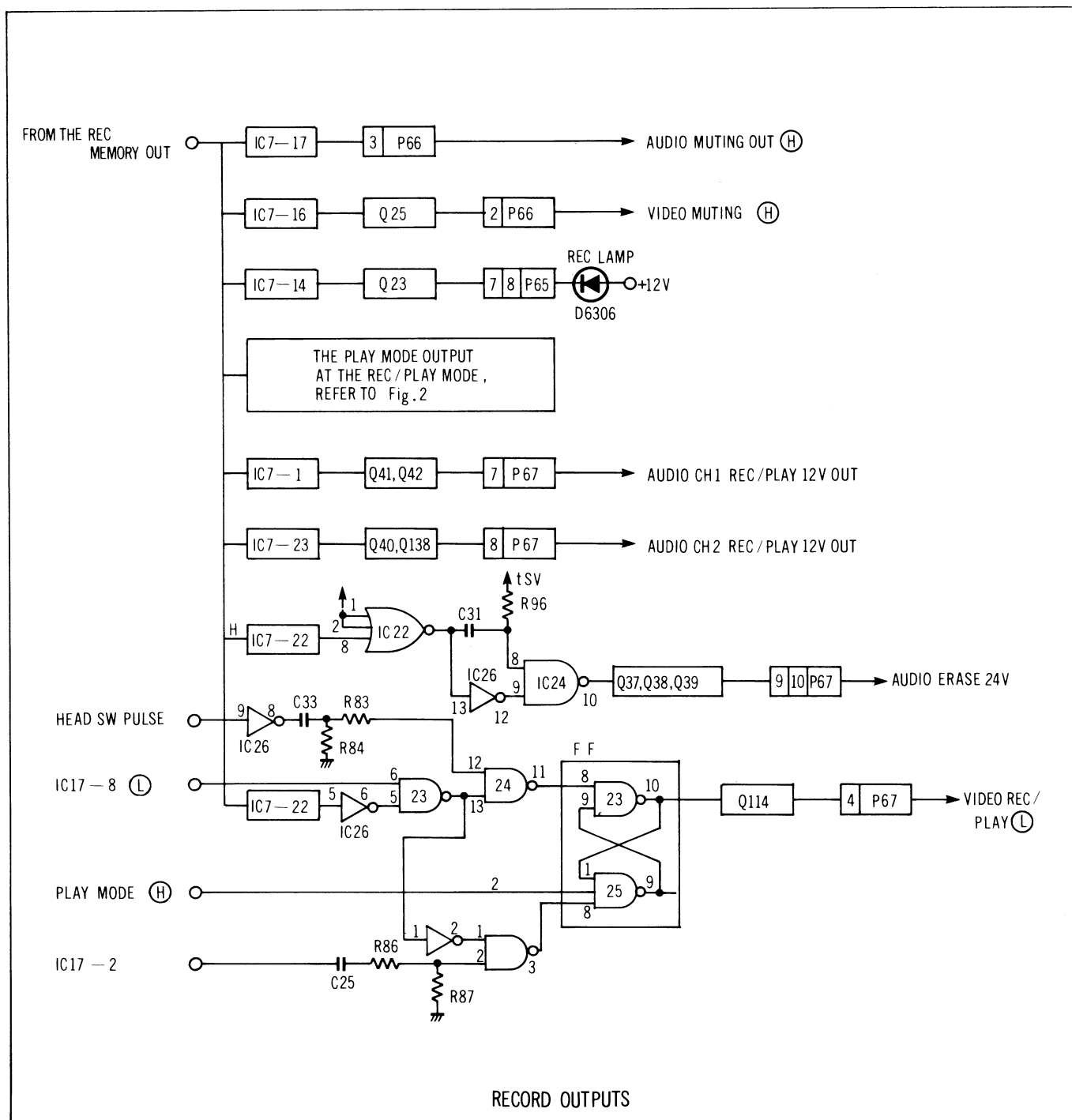


Figure 2-51

Insert Mode

The Insert memory inside the MPU can be described as on Insert set gate, an Insert memory flip-flop and an Insert memory Reset gate.

When the Record inhibit switch is on, the low allows the Insert mode to function.

The unit may be set into the Insert mode by pressing the Cut-In button and either the Edit or Play button during playback.

The insert mode will depend upon the choice made by the Audio Channel 1, Audio Channel 2 and Video switches. No insert will be performed if none of these are active.

The Insert memory will be reset if the Play memory is reset, the Record memory is set, if any change is made in the Insert choice controls (A1, A2, V), if the unit is placed in Pause or if the Stand By lamp lights.

The insert choice commands (A1, A2, V) have dual inputs. The remote inputs have priority over local inputs. Local inputs are valid when all remote inputs are off. All Insert memory is reset by Record. Local inputs are momentary inputs, but the insert memory makes them appear as alternate-action.

Remote inputs are Insert Memory Outputs from the edit controller, and the insert memories of the deck follow the remote except when all the remote memories are off, and local control obtains.

These insert select memories can not be changed during the Insert mode.

Muting

Audio Muting for both channels is released during the Play and the Record mode. A high appears at IC7-17 which is sent to the Audio circuit board. The audio is however muted during the pause mode.

The video muting is released during Record and Play modes. When "KC" tape is used in the Pause mode, the video is muted. If "KCA" tape is used in the pause mode, the video muting is released. The video is also muted during the loading and unloading modes. To perform the video muting, a low appears at IC7-16 and it turns Q25 off, resulting the video muting signal high at P66-2.

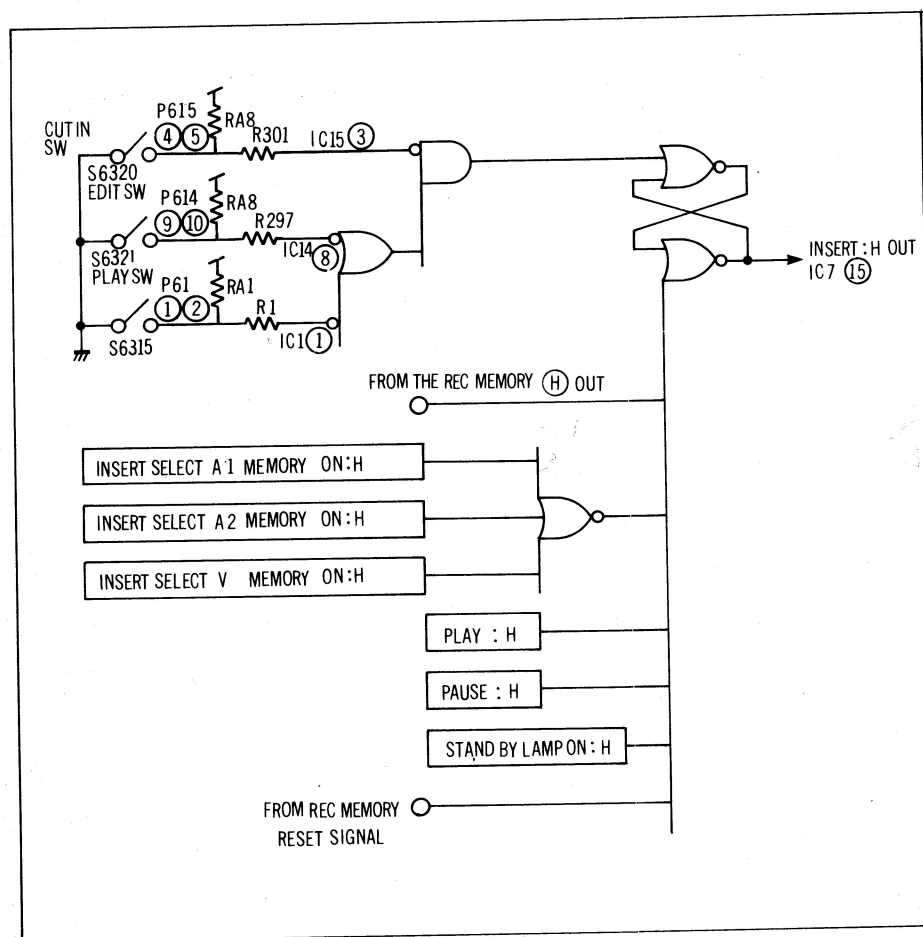


Figure 2-52

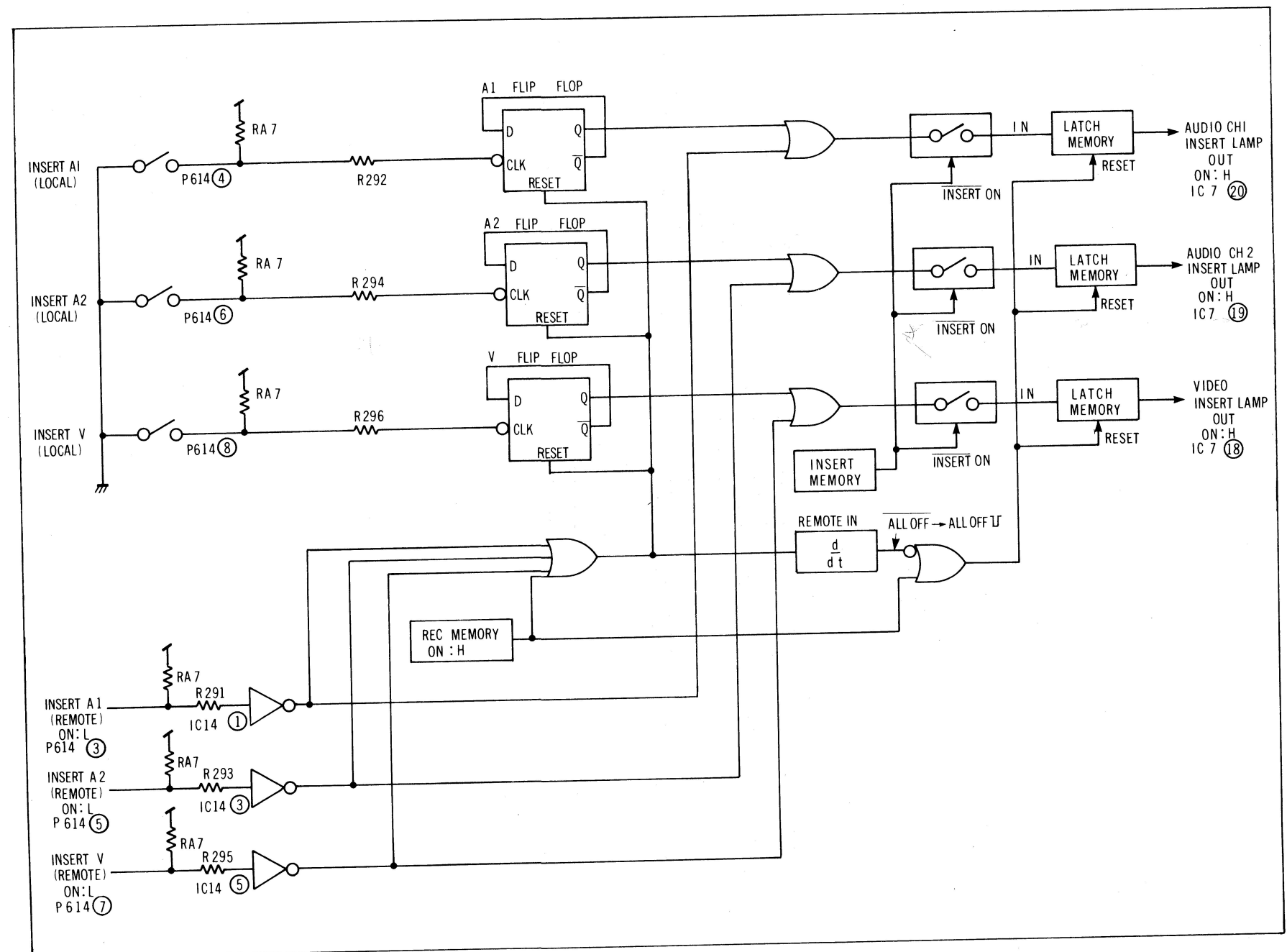


Figure 2-53

VIDEO RECORDING
CIRCUIT DESCRIPTION

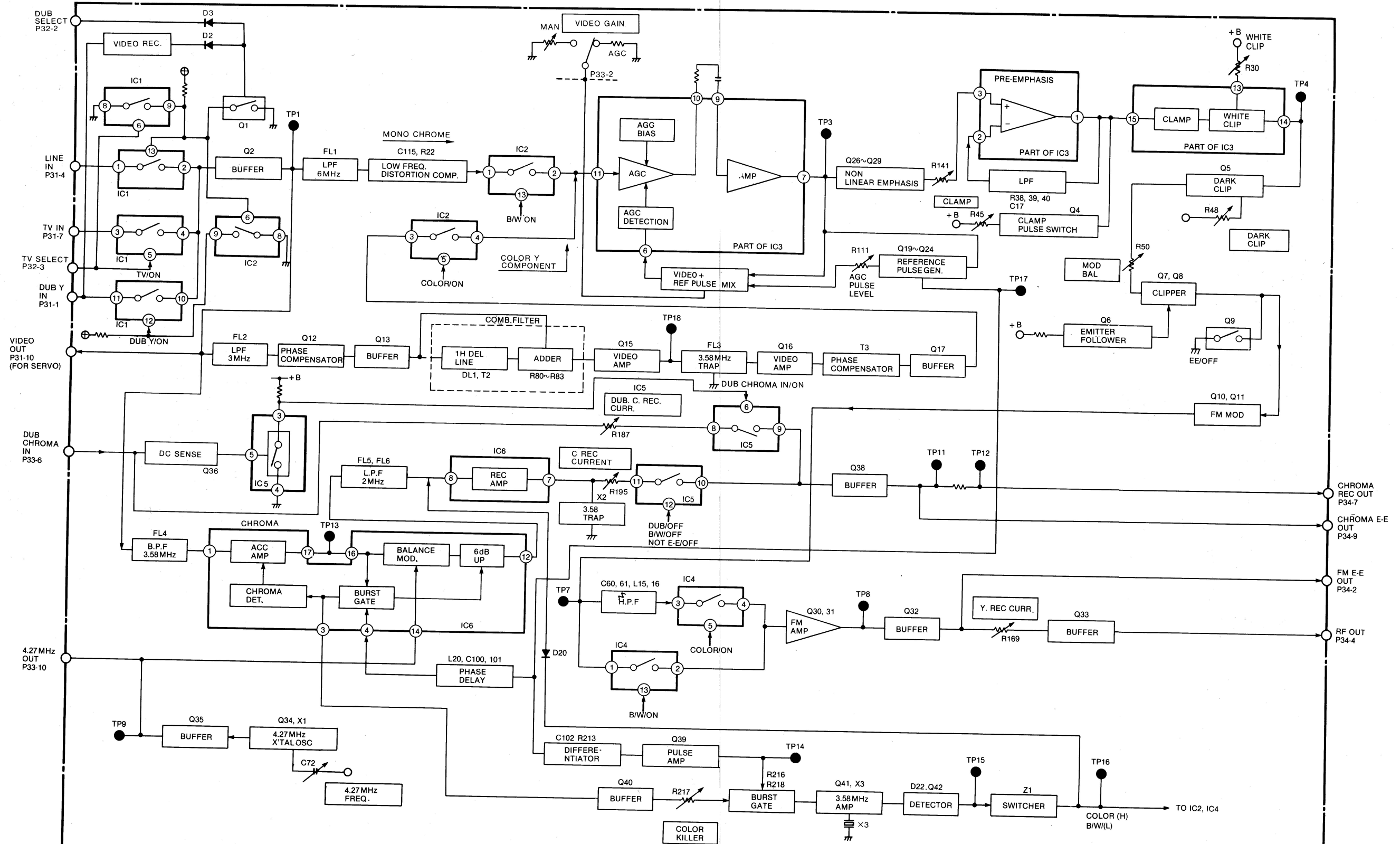


Figure 2-54

Introduction

The incoming video signal to be recorded is selected from three sources by the input selector on the front panel. This signal can be either color or black and white.

A color signal consists of two main portions; luminance (brightness information) and chrominance (color hue and saturation information).

The luminance information is similar to a black and white signal and has a frequency spectrum ranging from near 30 Hz to approximately 4 MHz. The chrominance information lies in a limited frequency band (± 0.5 MHz) centered at 3.58 MHz. In order to record such a signal, the two portions are separated and treated differently.

The luminance portion is FM modulated (as is a black and white signal), and the chrominance portion is converted in frequency to a band centered at 688 kHz by a heterodyne process.

By separating the two signals in this manner, interference between the FM modulated luminance signal and the chrominance information is reduced.

In addition, it is easier to compensate for playback time-base jitter of the chrominance signal within the heterodyne process of this system.

1. General Description

A. Luminance Signal

The input signal is selected by IC1, a switching stage.

The entire video signal is then sent through one of two low pass filters, depending upon whether the video signal is monochrome (BW) or color.

If the video signal is not color the low pass filter inserted should pass the entire signal up to the frequency which can be recorded by the VCR, and block higher frequencies.

This low pass filter is FL1, and the signal is then sent to a distortion (sag) compensator which makes up for certain undesirable effects caused by the low pass filter. If the video signal is a color signal, it must be stripped of its chrominance portion in order to provide a luminance only signal for FM modulation.

Since the chrominance portion lies in a narrow band centered at 3.58 MHz, the signal is first sent through a low pass filter (FL2), then a comb filter (T2, DL1, R80-R83), and finally to a low pass filter (FL3) for final frequency contouring. Since the chrominance signal will be processed separately through a lengthy path, a delay line (T3) matches the timing of the luminance signal to the chrominance. The video signal, containing only luminance information, is processed through several stages to prepare it for FM modulation.

The first stage is Automatic Gain Control (AGC), which attenuates or amplifies the signal as needed to produce a constant amplitude signal. The next stage is pre-emphasis, which boosts the high frequencies to compensate for the recording process. They will be attenuated during playback and demodulation (De-emphasis), in order to increase the overall signal to noise ratio. The signal is then clamped, which establishes a DC reference at the back porch of every horizontal sync pulse, (the video black level).

This allows the FM modulator to operate consistently regardless of changes in overall brightness.

Finally, the signal is white clipped and dark clipped, removing extremely high or extremely low spikes generated as a by-product of the pre-emphasis circuit, thus preventing over-modulation.

This altered video signal is then converted into a frequency modulated signal by the FM modulator consisting of Q6-Q8, Q10 and Q11. If the original signal was color, then the FM signal is sent through a high pass filter network (R150, R151, C60, L15, L16) which blocks the lowest sidebands of the FM signal. This prevents interference when the converted chrominance signal is later mixed with the FM signal. If the original was black and white, then this high pass filter is bypassed.

The FM signal is then amplified by Q30-Q32 and sent to the Record Amplifier Circuit (VEP0387).

In the event of color, the converted chrominance signal is mixed in the Record Amp and fed to the video heads via the rotary transformer.

B. Chrominance Signal

The entire video signal, in addition to following the path described for the luminance signal, is also sent to a band pass filter (FL4) in order to extract the chrominance portion, 3.58 MHz ± 0.5 MHz.

The chrominance signal is then fed to the Automatic Chroma Gain Control (ACC) circuit within IC6, which automatically adjusts the amplitude of the chrominance signal by measuring the burst amplitude, and amplifying or attenuating the entire chrominance signal until the burst amplitude is correct.

After the chrominance signal has been set to its proper level by the ACC, the signal is converted in frequency from the region of 3.58 MHz to the region of 688 kHz. This is accomplished by sending the chrominance signal along with a 4.27 MHz signal to two inputs of a balanced modulator within IC6. The 4.27 MHz signal is produced by an oscillator consisting of crystal X1 and Q34.

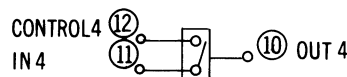
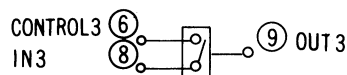
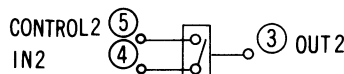
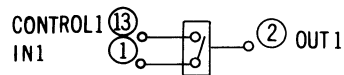
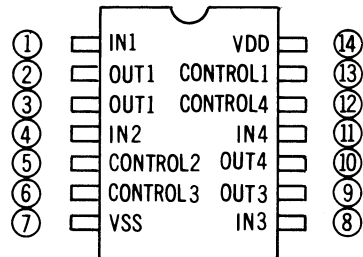
The output of the balanced modulator contains both the frequency sum and difference of the two input signals. The frequency difference is 688 kHz, and this desired portion is extracted by a low pass filter (FL5), eliminating the frequency sum portion (7.85 MHz).

This 688 kHz chrominance signal is then current amplified inside IC6, and sent to the Record Amplifier board. There it is mixed with the luminance FM signal, and sent to the video heads along with the luminance portion.

2. Detailed Description

Video Input Selector (IC1 μ PD4066C)

The video signal to be recorded can come from one of three sources: the video line (from the rear panel video input connector, J6301); a TV monitor (from the rear panel 8-Pin connector, J6312); or the video signal for dubbing (from the rear panel 7-Pin connector, J6310).



CONTROL	SWITCH
0	OFF
1	ON

Figure 2-55

The three video signals are sent simultaneously to IC1 (μ PD4066C) which is a Quad Bilateral Switch. IC1 consists of four independent FET switches which will pass either digital or analog signals. Pin Assignment, Block Diagram and Truth Table of IC1 are shown in Fig. 2-55. IC1, IC2, IC4 and IC5 of the Video Recording Circuit are identical. Only one of the signal switches is on at a time as determined by the Input Selector switch, which applies +12V to the control inputs of IC1, and the presence of a DUB signal. (See Fig. 2-56.) Note that some sections of IC1 and 2 are used for signals, and some sections switch DC for logic control.

When the Input Selector (S6311) is in the TV position, +12V through connector P32-3 is supplied to Pin 5 so that the video signal from connector P31-7 appears at Pin 4.

If the Line mode is selected, Q1 remains off because D3 and R19 conduct.

The +12V supplied to Pin 13 through R9 enables the video signal from the connector P31-4 to Pin 2.

In the Dubbing mode, +12V from P32-2 cuts off D3 to turn Q1 on, so Pin 13 becomes low. Pin 12 becomes high because IC2 Pin 9 has been held at ground by Q1 through R23 to Pin 6.

The dubbing luminance (Y) signal is multiplexed with a d.c. level of about 5 volts. If there is no d.c., the dubbing cable may not be connected, and the deck reverts back to line mode. No d.c. causes D2 to conduct through R13, R14 and R15, turning off Q1, IC2 Pin 9 low, and IC1 pin 13 high. Line video appears at the IC1 common point, Pins 2, 4 and 10. The Dubbing video signal then goes to Pin 10. The selected signal goes to a buffer (Q2) before being sent to both the luminance record and chrominance record circuits.

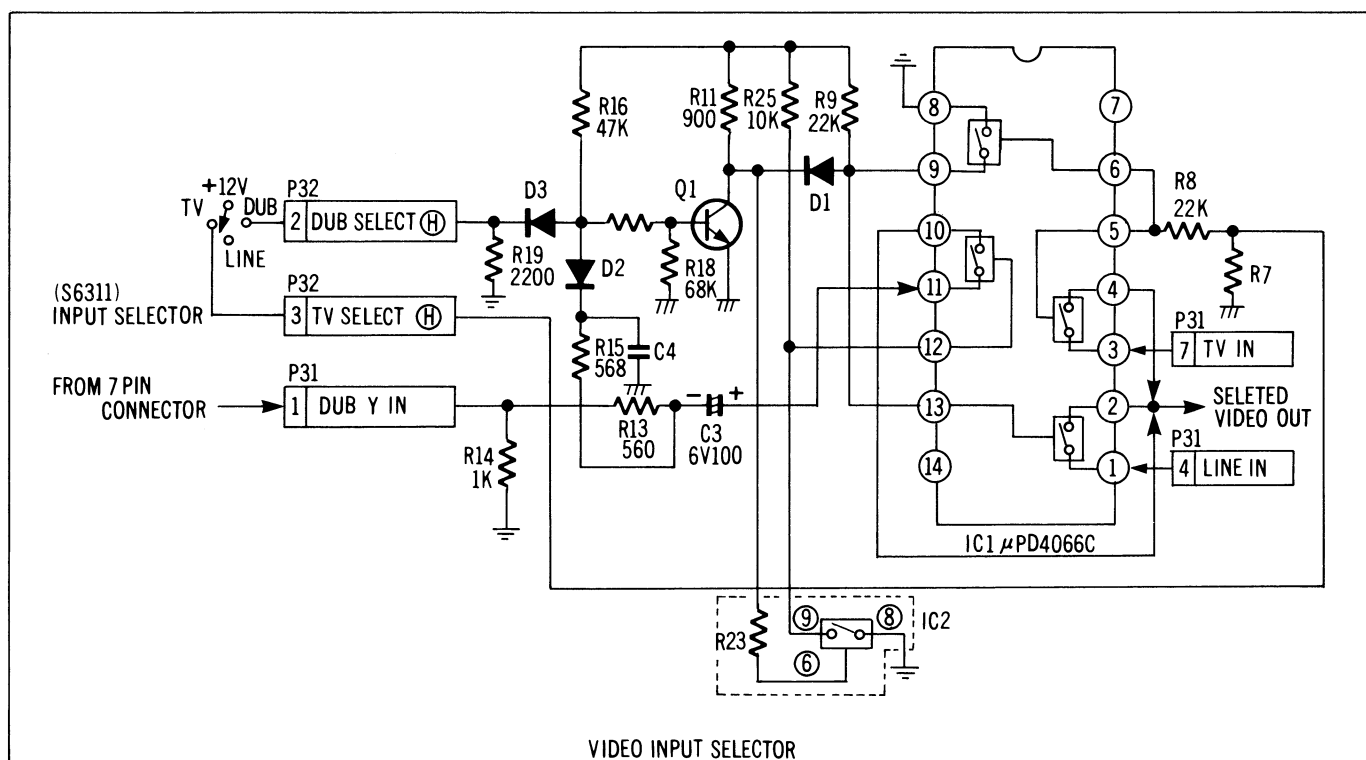


Figure 2-56

Luminance Signal

Low Pass Filter

As previously described, the selected video signal is sent to two low pass filters simultaneously. The output of one of them is used if the signal is black and white, and the output of the other one is used if the signal is color. The purpose of the low pass filter for a black and white signal is to remove those frequencies which can not be properly recorded on the tape.

This removes noise and other deleterious effects that this portion of the signal might have. The low pass filter is FL1. The signal is then sent through a low frequency distortion (sag) compensator which consists of C115 and R22. The total response of the low pass filter with compensation is shown in Fig. 2-57.

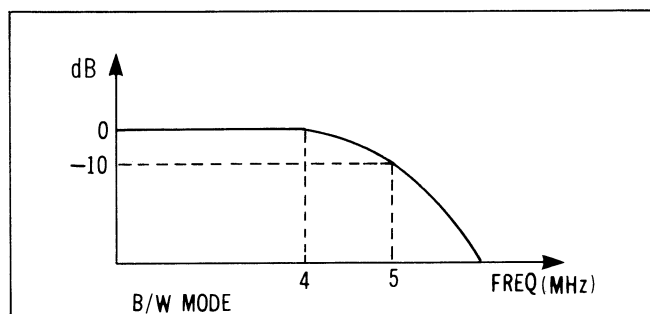


Figure 2-57

This signal is sent to a signal switch (IC2-1, 2) which is on only during the B/W mode (IC2-13 is high through R24). For color signal, the low pass filter FL2 serves to remove only the upper-most chrominance portion from the total signal.

Removal of the chroma from the luminance portion is accomplished with a comb filter (T2, DL1, R80-R83). The signal is then sent through an amplifier (Q15) which acts as a high frequency peaker for the 2-4 MHz region. This assures flat response to 4 MHz by compensation for some of the roll-off caused by the low pass filter and the comb filter.

The signal is then sent to a delay line (T3) through an amplifier (Q16) so it will coincide later with the chrominance portion, which is phase delayed due to signal processing within the color record circuits. The 3.58 MHz trap compensates for any carrier leak through the comb filter. The total response is shown in Fig. 2-58.

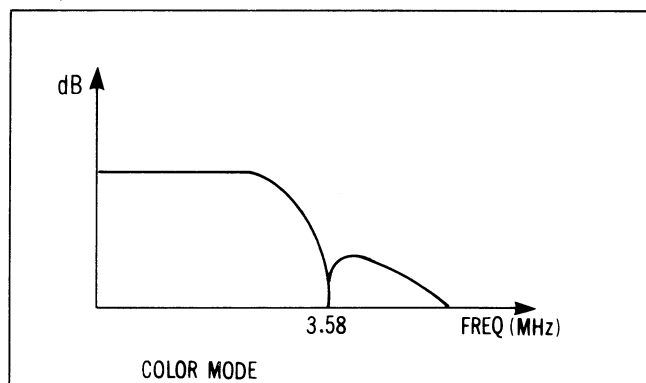


Figure 2-58

Q17 is a buffer, and its output is sent to a signal switch inside IC2 (Pin 3 and 4), which is on only during the color mode (Pin 5 is high through R226).

The type of signal (color or black and white) is automatically detected by a Color Killer Circuit that develops a Color-High signal (high during color, low during B/W). This signal, in turn, determines which switch in IC2 is on. The IC2-10, 11 switch with R24 forms a logic inverter function, driven by the color sense signal. The output signal is then sent to the AGC circuit.

Comb Filter

As is established by design, the NTSC system dictates that the chroma carrier is out of phase for every successive horizontal line.

Therefore, when an NTSC color Signal is supplied to the unit, the luminance and chrominance signals may be separated by a comb filter consisting of a 1 H delay line (DL1) and a bridge circuit (R80-R83). This technique allows the luminance and chrominance signals to be separated without the loss of the high frequency luminance components which lie in the same part of the spectrum as the chrominance signal. Refer to Fig. 2-59.

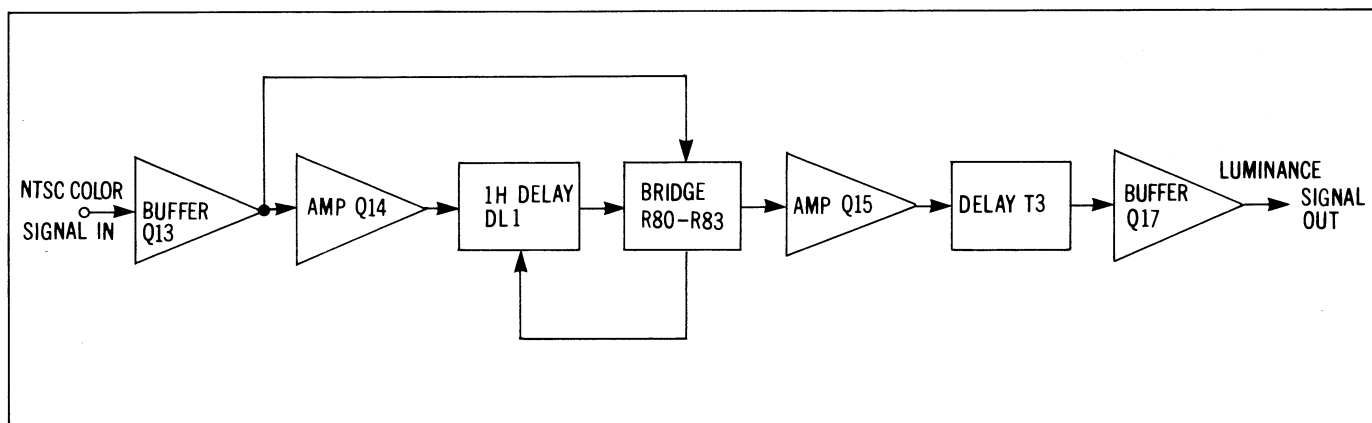


Figure 2-59

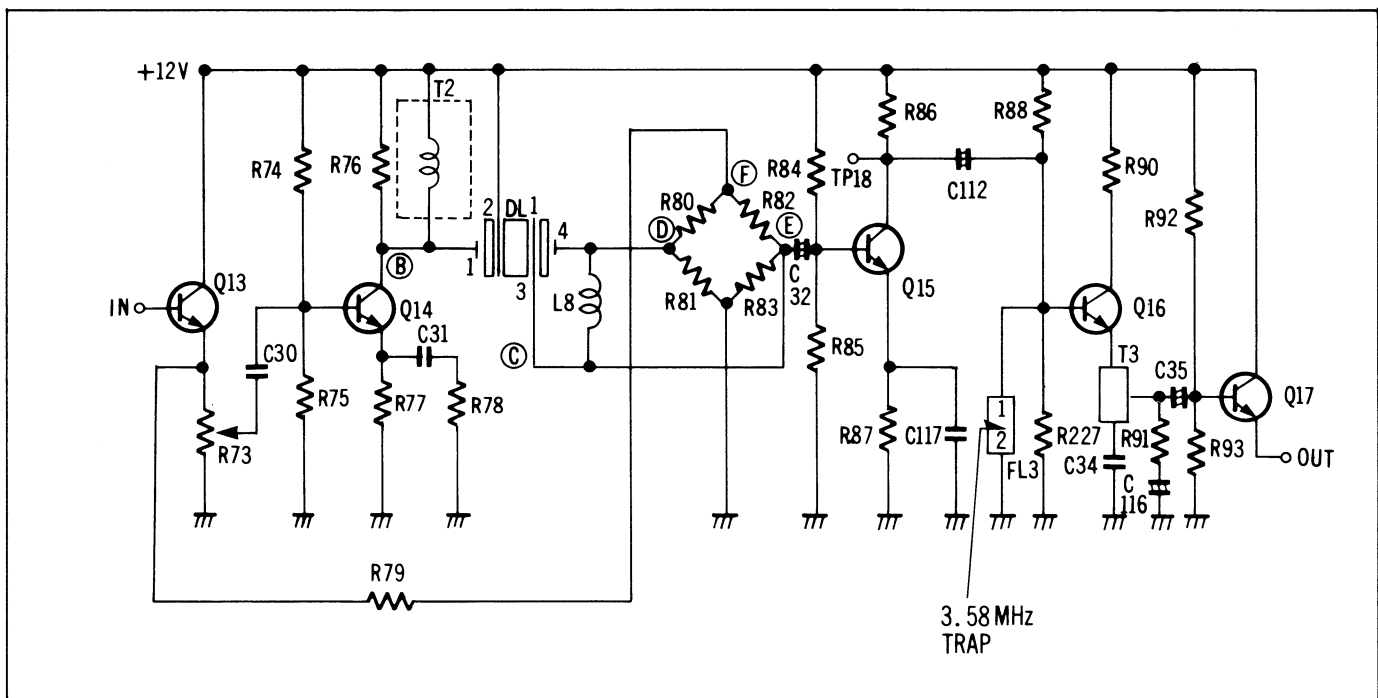


Figure 2-60

As shown in Figure 2-60, the NTSC color signal is buffered by Q13 and supplied to point (F) through R79, and to the base of amplifier Q14, through the limited coupling circuit (C30).

In this fashion, only the high frequency luminance components and the chrominance signal are passed to the base of Q14 through the MIX LEVEL (R73).

These high frequency signals are amplified by Q14. An inverted signal is obtained at the collector of Q14, (B).

This signal is fed to terminal (1) of the 1H delay line (DL1). The bandwidth of this delay line is about 1 MHz, centered at the 3.58 MHz chrominance signal frequency. The other input terminal of this delay line, terminal (2), is AC ground (the +12V bus).

The output of the delay line is taken across terminals (3) and (4). An in-phase signal is obtained from terminal (3) of the delay line, and its return path is into terminal (4) of the delay line.

The comb filter output signal is taken across R83. The undelayed signal from R79 travels downward through R83 to ground. The delayed signal which exits the delay line from terminal (3) also passed downward through R83 on its path back to terminal (4).

Therefore, the voltage addition of these two signals occurs across R83.

The luminance portions will add to produce a double level luminance signal.

Because of NTSC interleaving, the chrominance signal phase between any two adjacent lines in a field is 180° apart, so the normal chrominance signal and the 1 H delayed chrominance signal passing through R83 are 180° apart, and will cancel. See Fig. 2-61. The signal passed through C32 to the base of Q15 is a luminance only signal with no loss of high frequency information but without chroma.

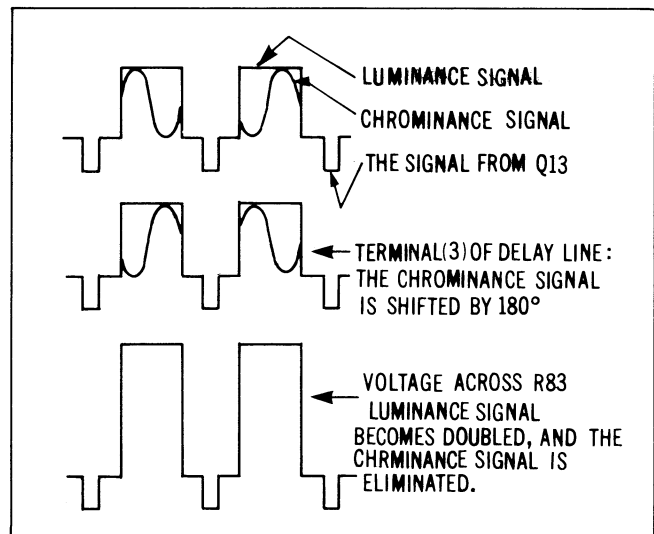


Figure 2-61

AGC (Automatic Gain Control) Circuit

The AGC automatically amplifies or attenuates the video signal as may be required to bring it to a preset level.

However, unlike a conventional peak detecting AGC, this keyed AGC detects only the amplitude of the sync portion, and then adjusts the signal gain until the sync portion is the proper amplitude. The disadvantage of a peak detecting AGC is that it measures the overall peak to peak level and controls the gain based on tip of sync to peak white level. Should the original signal have few whites (by design), the peak AGC will over-compensate and produce excessive gain, sync stretch and loss of original visual effects.

This does not happen with a keyed AGC, because sync is restored to the proper level independent of video (picture) content. Therefore, the overall video will be restored to its intended original level.

The AGC functions by first sending the video signal through a variable gain (AGC) amplifier within IC3, and then through another amplifier within IC3 to exit at pin 7. A reference pulse is then generated from H sync by Q19-Q22. This pulse, whose amplitude is set by R111, is timed so it fits within the back porch of each horizontal blanking period of the video signal. This reference pulse is then algebraically added to the back porch of the video signal by Q23-25. See Figure 2-63.

The resulting video signal with added reference pulse is then peak detected by the AGC detector within IC3, which in turn controls the gain of the AGC amplifier.

Figure 2-62 shows examples of the same video signal with two different amplitudes. In example (A) the amplitude is low. In example (B) the amplitude is normal. The reference pulse always has the same amplitude, but because the sync amplitude in example (A) is lower than in example (B), the peak level is also lower. This low peak level is detected and the gain of the AGC amplifier is increased until the peak level reaches that of example (B).

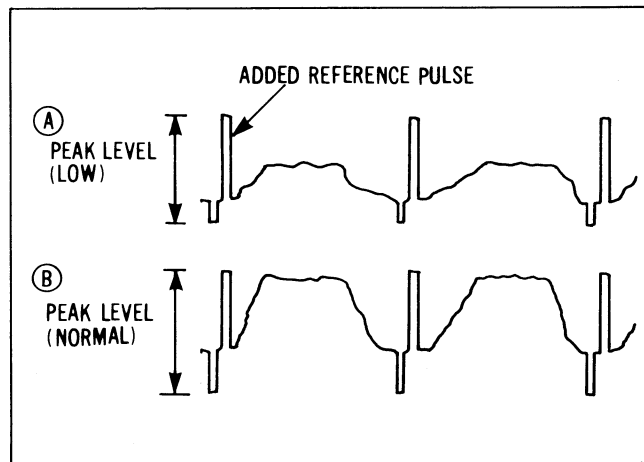


Figure 2-62

Actually, the polarity of the video signal with added reference pulse is the inverse of the shown above. It is shown this way in order to make it easier to visualize.

In the unlikely event that the ratio of video to sync is greater than the standard 0.7 : 0.3, then the AGC detects the video peak and not the reference pulse, since video would be higher than the reference pulse. In this case, the sync amplitude would be less than normal in order to prevent the overall signal from exceeding peak white, which would cause overmodulation.

The reference pulse is not part of the actual AGC output signal, but is only used internally for the AGC detector.

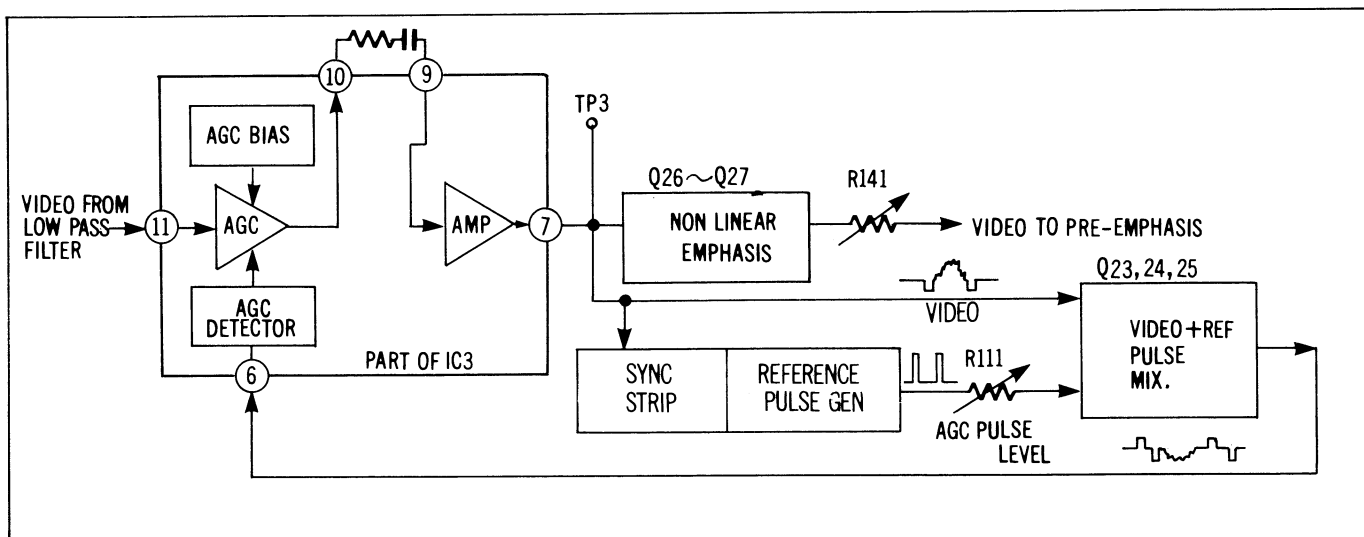


Figure 2-63

Reference Pulse Generator (Q19-Q24)

The video signal from IC3 pin 7 is first buffered by emitter follower Q19. Horizontal sync is then separated by Q20 and inverted by Q21 (See Figure 2-64 (2),(3)). Since the reference pulse must coincide with the back porch of horizontal blanking, the horizontal sync signal must be slightly delayed.

This is accomplished by differentiating the sync signal with C41, R107 and R108.

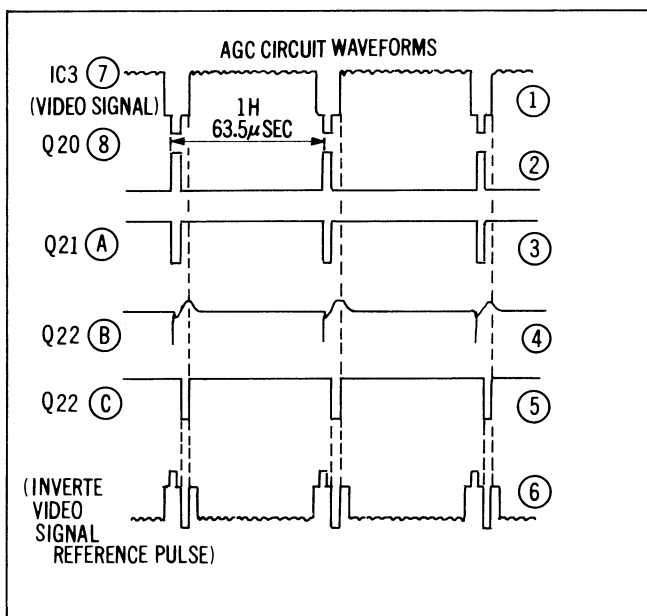


Figure 2-64

The positive going edge (trailing edge) then triggers Q22 (Figure 2-6-4 (4)) creating a negative going pulse, slightly delayed from horizontal sync at the collector (Figure 2-64 (5)).

This pulse, whose amplitude is adjustable by R5, is the reference pulse which is mixed with the video signal at Q23. This mixed signal is inverted at the collector (Figure 2-64 (6)) and sent through buffer Q24. This is the signal which is then sent to the AGC detector to control the gain of the AGC amplifier within IC3 (Refer to Figure 2-65).

Non-Linear Emphasis

Non-Linear Emphasis boosts the level of the high frequency portions of the signal, inversely proportional to absolute level (more boosting is performed upon low-level signals than higher-level signals).

Upon playback, these signals will be non-linearly deemphasized, restoring the signal to its original level, and reducing noise in the process.

The Non-Linear Emphasis input signal is buffered by Q26 and passes through C49, which performs as a high pass filter, to be amplified by Q27.

Then the high frequency signal is routed through the dual diode limiter (D10, D11) which conducts to limit the signal when the amplitude is sufficient to produce forward bias. The signal from the emitter of Q26 is also supplied to the emitter of Q29, and mixed at Q29 with the boosted high frequency signals from Q27.

Thus high frequency, low-level signals undergo more emphasis (amplification) than high-level signals. In this way,

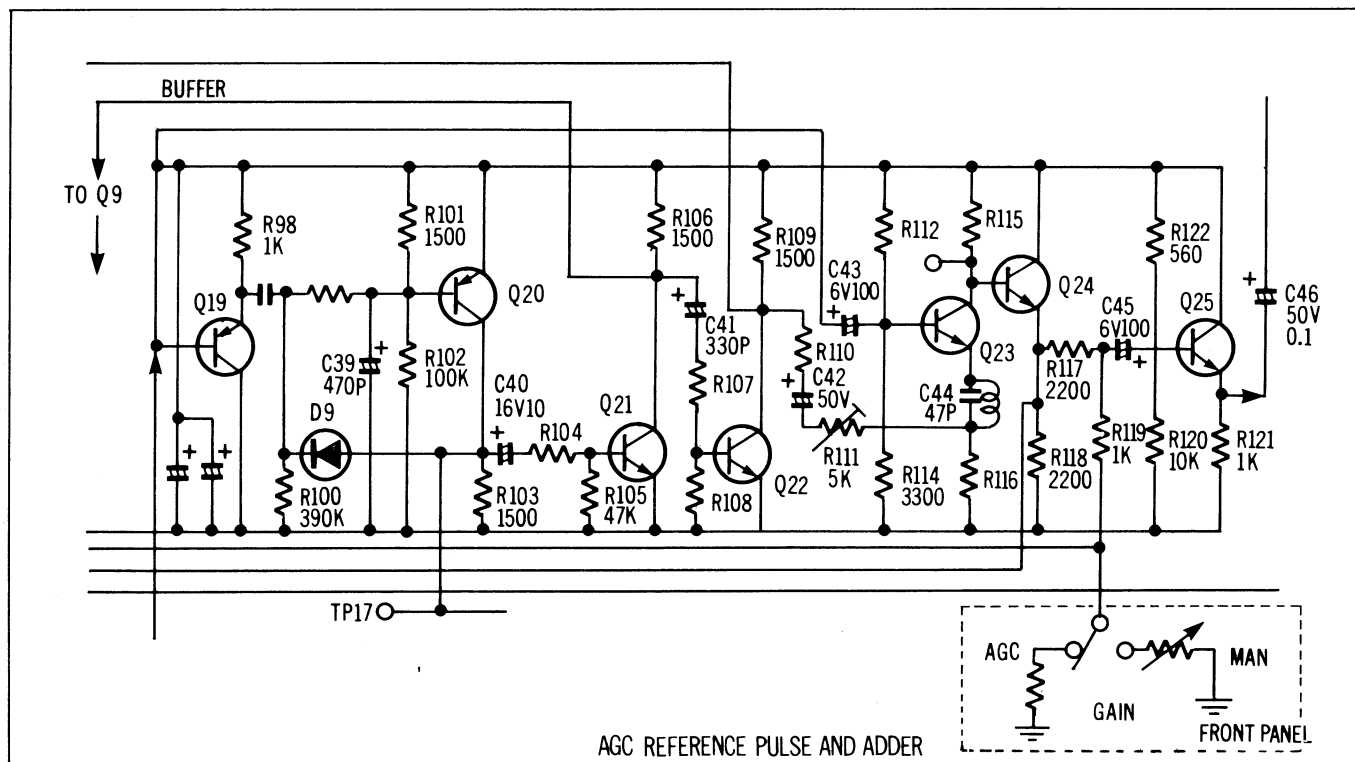


Figure 2-65

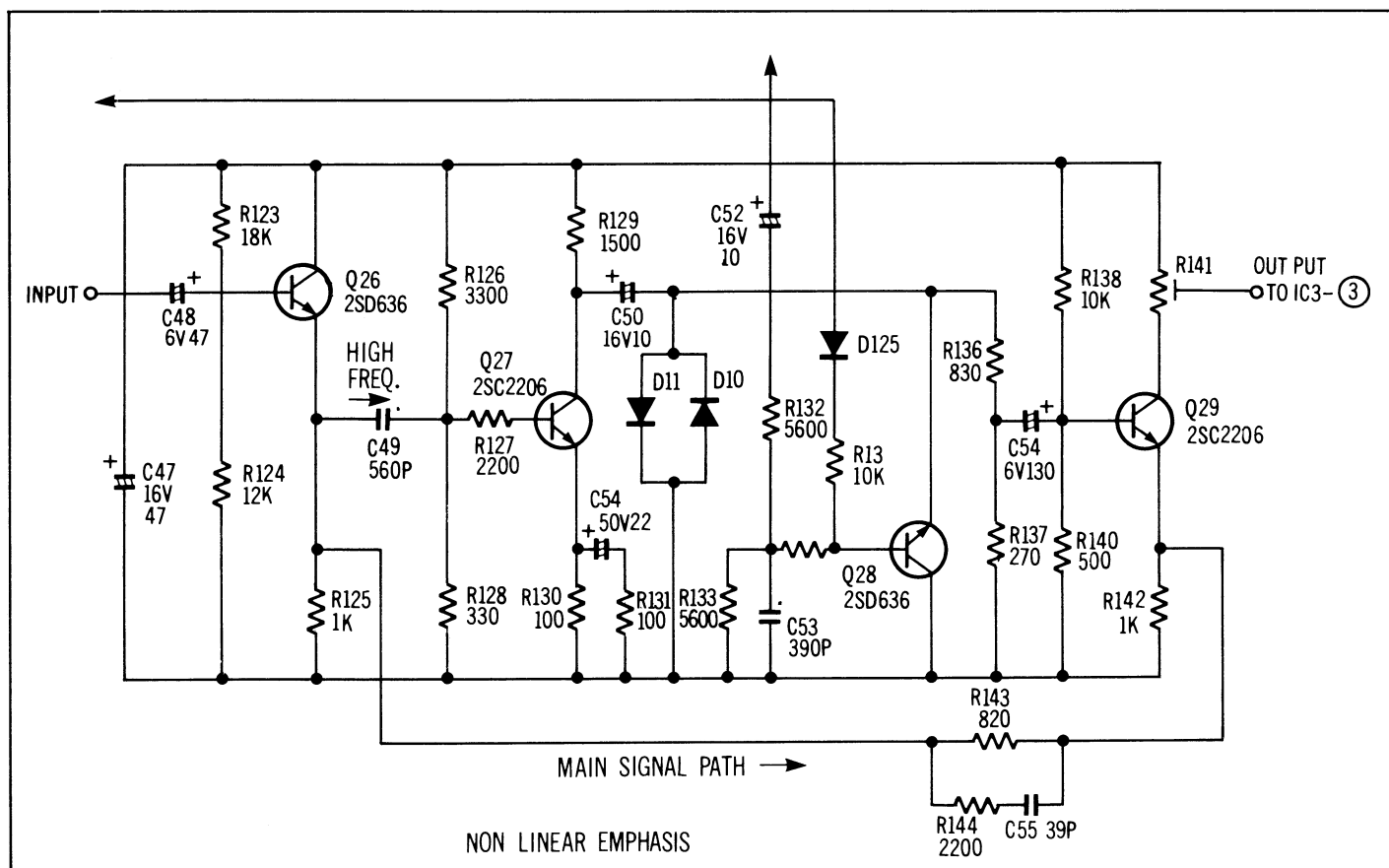


Figure 2-66

the boosted low level portions of the signal can be “pulled out” of the noise, when considering the entire emphasis-deemphasis process. Q28 is switched on to mute the high frequency gain during the dubbing mode and during color burst by supplying a high to the base.

Q28 functions as a high speed diode, conducting through R136, R137.

Pre-Emphasis Circuit

The output of the AGC circuit and the Non Linear Emphasis stage, whose output level is adjustable by R141, is then sent to the Pre-Emphasis circuit within IC3. The Pre-Emphasis circuit boosts the higher frequencies within the pass band of the video low pass filter.

During playback, there will be an equal and opposite attenuation of the high frequency region, called de-emphasis.

This pre-emphasis, de-emphasis combination increases the signal to noise ratio of the record-playback process for the following reason. After the video signal is FM modulated, the frequency of the FM signal at any instant will correspond to the absolute amplitude of the original video signal at that instant. During the process of modulation, recording, and play back noise is generated and the effect of the noise after demodulation is a function of the frequency of the noise.

For example, if the FM signal at some moment is 4.7 MHz, (which corresponds to a gray level video signal) the effect of the noise (noise level after demodulation) vs. noise frequency is shown in Fig. 17.

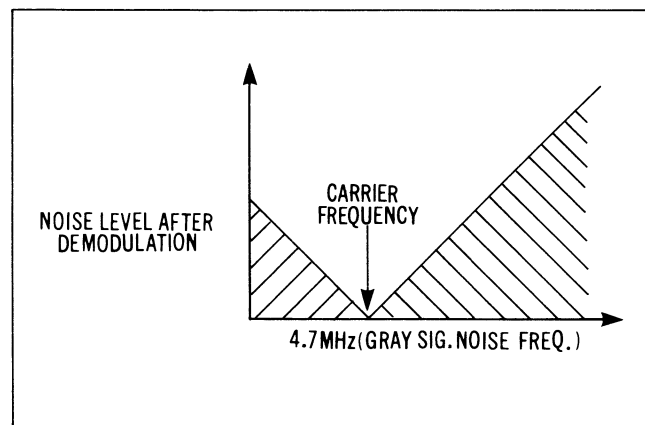


Figure 2-67

Any noise which is at 4.7 MHz has no effect at all. However the further away from 4.7 MHz the noise frequency is (either higher or lower), the more deleterious the effect it has upon demodulation. A similar graph can be drawn for any other frequency within the range of the system (3.8-5.4 MHz).

By pre-emphasizing the signal during record and de-emphasizing during playback, the overall video response will be flat, but high frequency noise (corresponding to noise further away from the carrier) is reduced, especially in the area of video detail (higher frequencies).

The pre-emphasis circuit consists of an amplifier within IC3, R38-R40 and C17 as shown in Fig. 2-68. The video signal is applied to the non-inverting input of the pre-emphasis amplifier at Pin 3 of IC3. The output is at Pin 1, and negative feedback for the low frequencies is accomplished by first sending the output through a low pass filter (R38-R40, C17) and then applying the signal to the inverting input at Pin 2 of IC3. Since negative feedback is applied for low frequencies only, the result is the response curve as shown in Fig. 2-69.

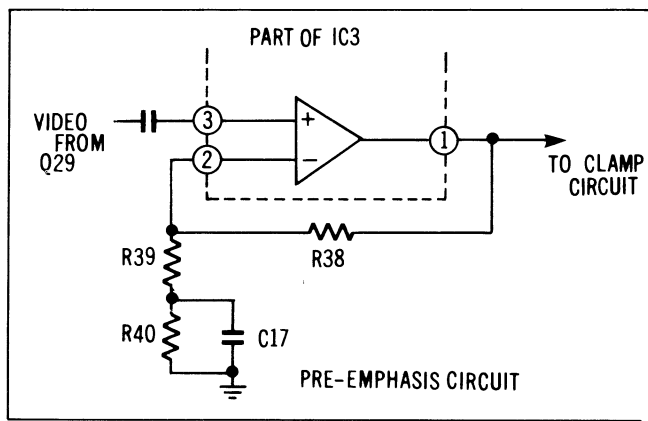


Figure 2-68

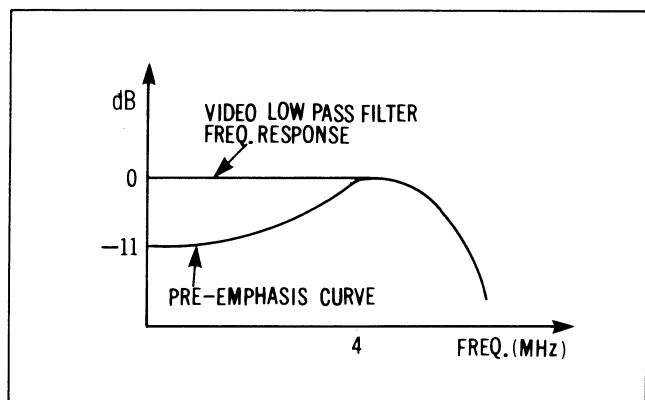


Figure 2-69

Clamp Circuit

Up to this point, the video signal has been capacitively coupled, and therefore has no DC reference. The FM modulator requires that the video signal has a DC reference so that a specific video level corresponds to a specific FM frequency. The purpose of the clamp circuit is to establish a DC reference for the back porch of each horizontal sync pulse of the video signal.

The clamp circuit functions as shown in Figure 2-70. The video signal from the pre-emphasis circuit enters C18.

Normally Q4 is off, but during the back porch period a negative going clamp pulse is sent to the base turning it on. At this point, the voltage applied to the emitter by R45 is sent through the collector to C18. C18 charges to this voltage minus the potential of the video signal (back porch) at that instant.

After Q4 turns off, C18 retains this charge and the capacitor passes the video signal.

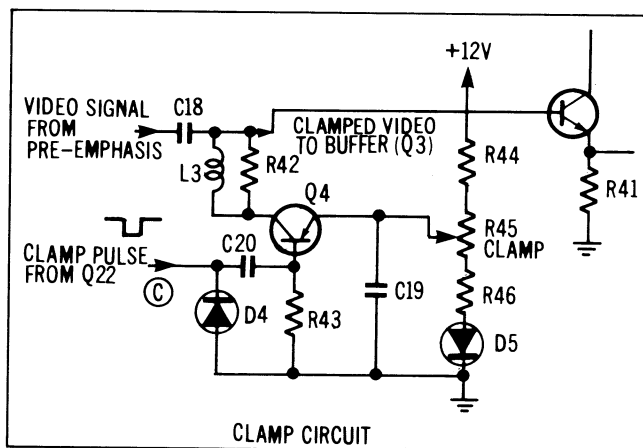


Figure 2-70

The DC level to which the back porch is clamped is adjusted by R45 and is set so that the FM modulator produces 4.2 MHz. Thus the video pedestal level will correspond to 4.2 MHz. (See Figure 2-71)

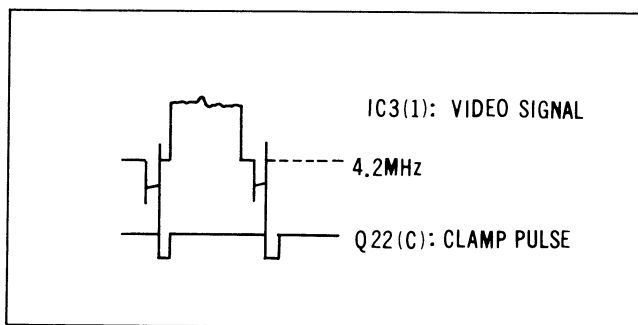


Figure 2-71

White Clip-Dark Clip Circuits

After the video signal was pre-emphasized, considerable over-shoots were created by the high frequency boost. Any over-shoots which exceed peak white by 0.5 V or which go below sync tip by more than 0.3 V, would cause over-modulation.

The positive over-shoots are clipped by the White Clipper to a level set by R30. The negative excursions are clipped by Q5, which turns on whenever the signal goes below the level set by R48. D6 provides temperature compensation. (See Figure 2-72, 73).

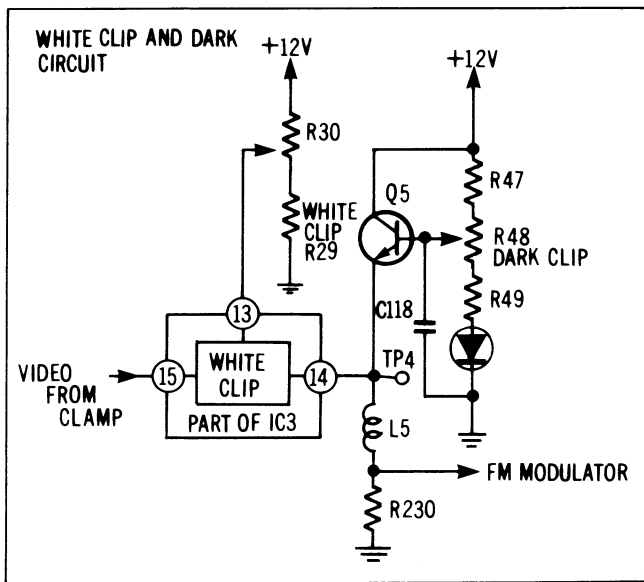


Figure 2-72

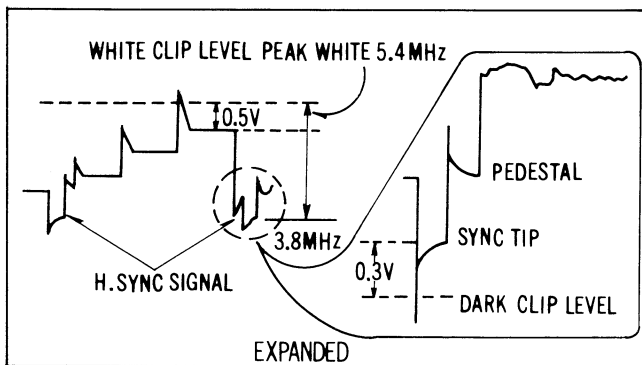


Figure 2-73

FM Modulator

Q10 and Q11 form an astable multivibrator whose free-running frequency is determined by a combination of C22, C23, R55, R56, R50 and the bias voltage applied to the bases of Q10 and Q11 (See Figure 2-74).

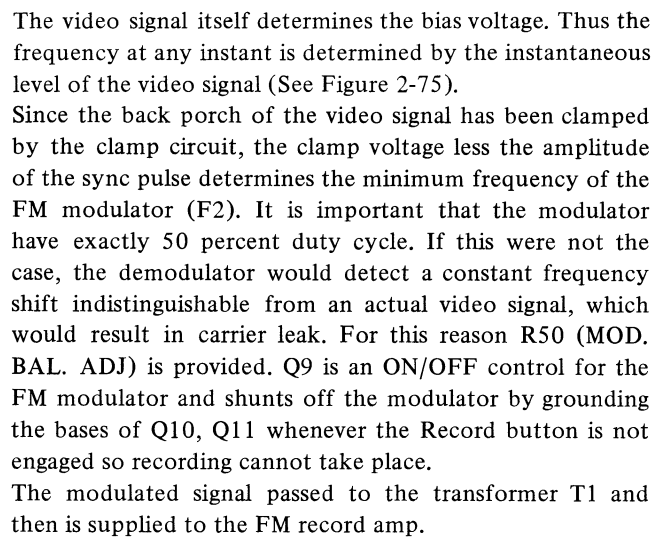


Figure 2-75

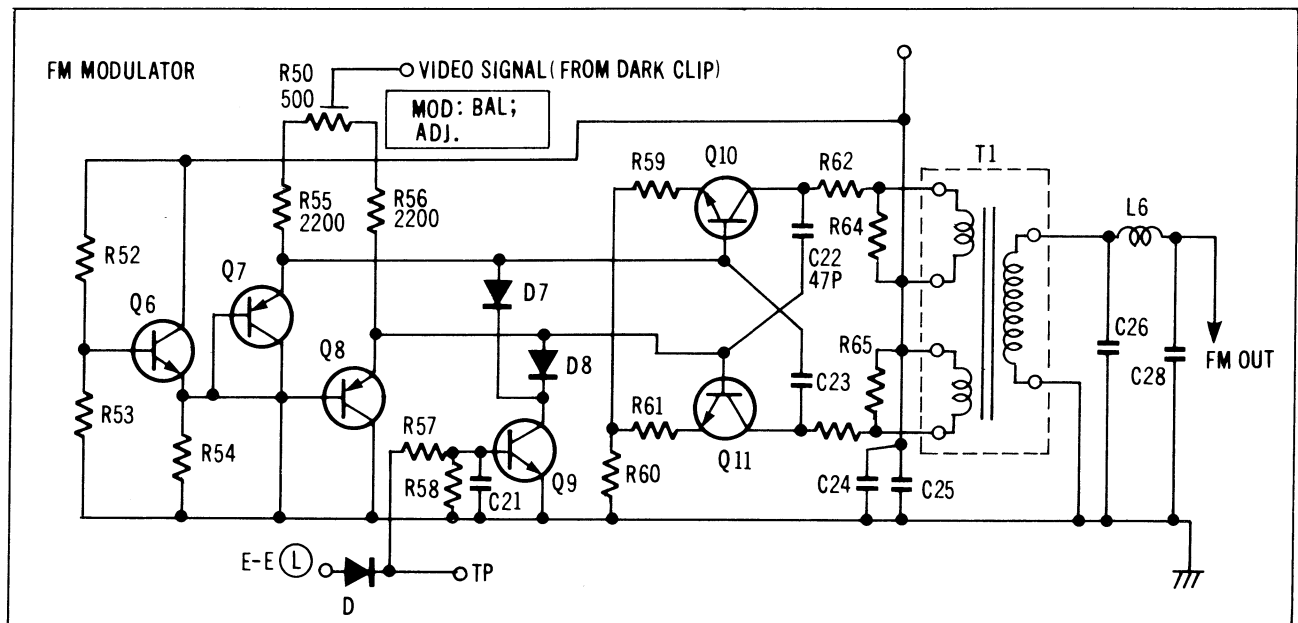


Figure 2-74 1—82

Clipper (Q6-Q8)

The purpose of the clipper is to improve the waveform symmetry of the FM modulator. It is a basic characteristic of transistors that once a transistor is saturated (fully on) it takes longer to shut it off than it takes to turn it on. Since the transistors in an FM modulator are usually being turned on and off at a very rapid rate, if the turn on time is not exactly the same as the turn off time, good symmetry cannot be obtained. For this reason Q7 and Q8 act as clippers preventing the modulator transistors Q10, Q11 from fully turning on. Thus the modulator transistors operate between cut-off and the active region and never reach saturation. The clipping point is determined by the bias supplied by R52 and R53 through emitter follower Q6 (See Figure 2-76).

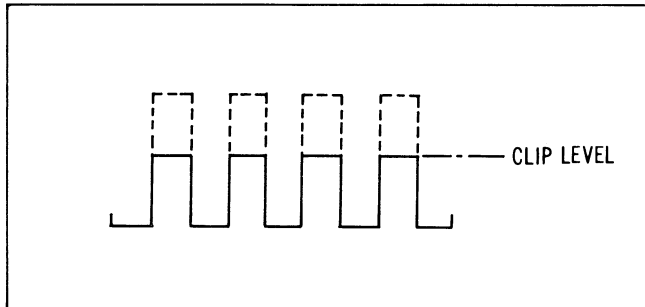


Figure 2-76

FM Filtering

After the video signal is converted into FM, the FM signal is sent through several stages of filtering. The first one is a low pass filter consisting of C26, L6 and C27. This removes high frequency harmonics which are not useful in the recording process.

The signal is then sent two ways. A high pass filter consisting of R147-R152, C60, C61 and L15, L16 blocks all FM information below approximately 1 MHz. Therefore, when the converted chrominance information is later mixed in, there will not be any interference between the FM (luminance) and chrominance signals.

The output of this filter is sent to Pin 3 of IC4 for the color mode.

In addition, the FM signal prior to this high pass filter is attenuated by R145, R146 and goes to Pin 1 of IC4.

Only one of these signals will be utilized depending upon the Color (High) signal developed by the color killer circuit. If the Color (High) signal is present then the switch at IC4 Pin 3, 4 closes and the switch IC4 Pin 1, 2 will be open, since switch IC4 Pin 10, 11 will be closed.

When a Color (High) signal is not present (Black and White signal) the opposite is true.

A low appears Pin 5 and Pin 12 of IC4 opening the switches 3, 4 and 10, 11 (See Figure 2-77).

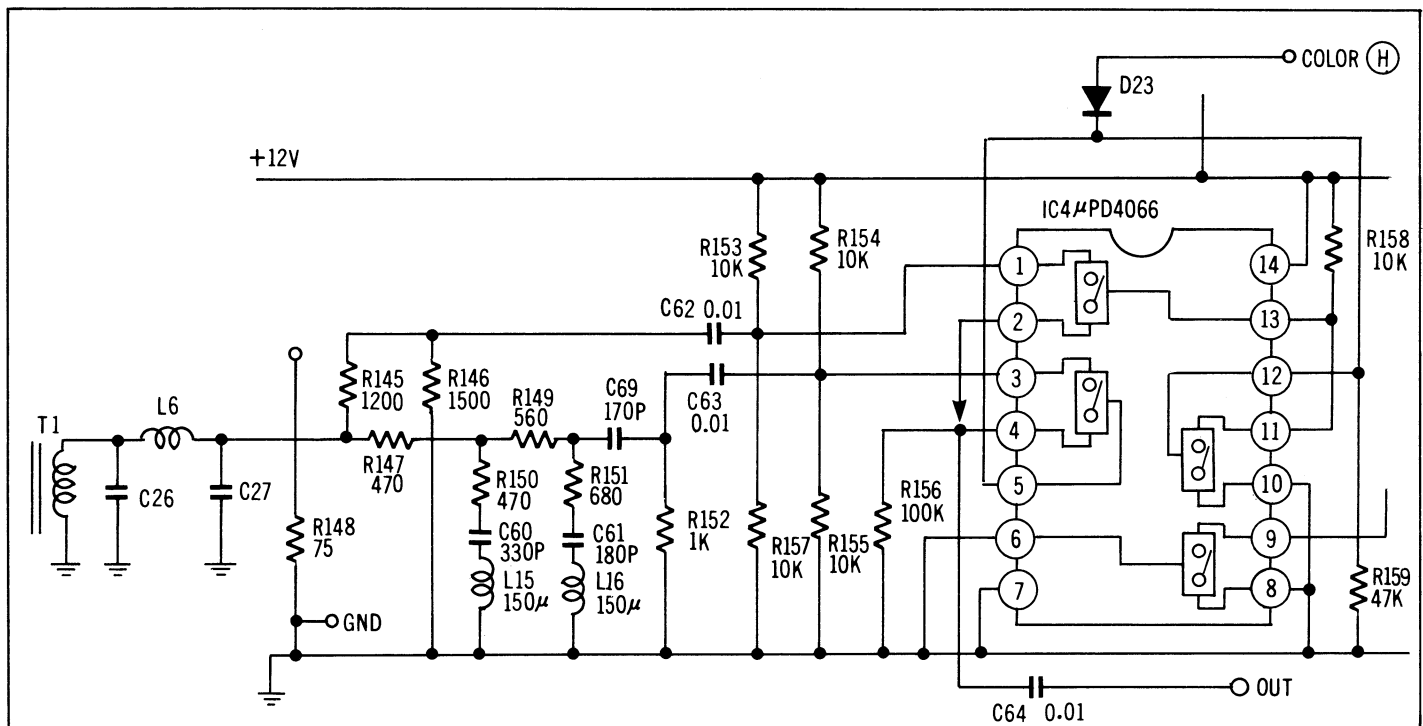


Figure 2-77

IC4 Pin 1, 2 is closed by R158 at Pin 13. In this case the filtered signal is blocked and the unfiltered, direct signal passes because there will be no chroma to cause interference. The output at Pins 2 and 4 is then sent to the FM output amp through C64.

FM Signal Output Amp.

This circuit provides two separately amplified outputs for the signal generated by the FM modulator. FM amp. (Q30, Q31) and emitter follower (Q32) provide an FM (E-E) signal which goes to the FM (E-E) input of the video playback circuit (VEP0386). This signal from Q32 is utilized for E to E operation only.

The other output is supplied to RF out (P34-4) through the luminance recording current adjuster (R169) and buffer (Q33). See Figure 2-78.

This signal is fed to the Record amplifier. (Q1-Q7) on the Rec Amp. Circuit board (VEP0387).

Chrominance Signal

Band Pass Filter

The video signal selected by the input selector is sent from Q2 to the band pass filter FL4, which removes the luminance portion and allows only the chrominance information to pass. The signal is then sent to the ACC circuit within IC6. The frequency response of the filter is shown in Fig. 2-79.

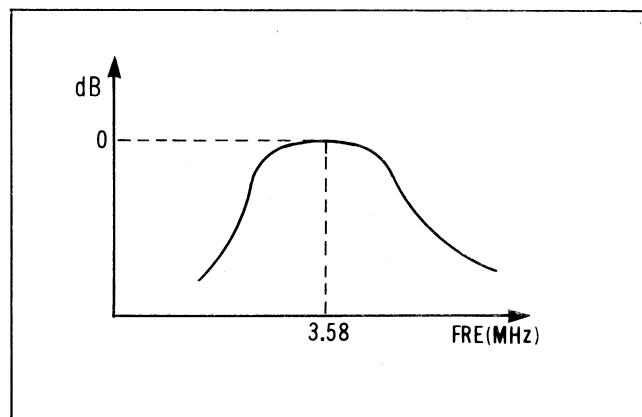


Figure 2-79

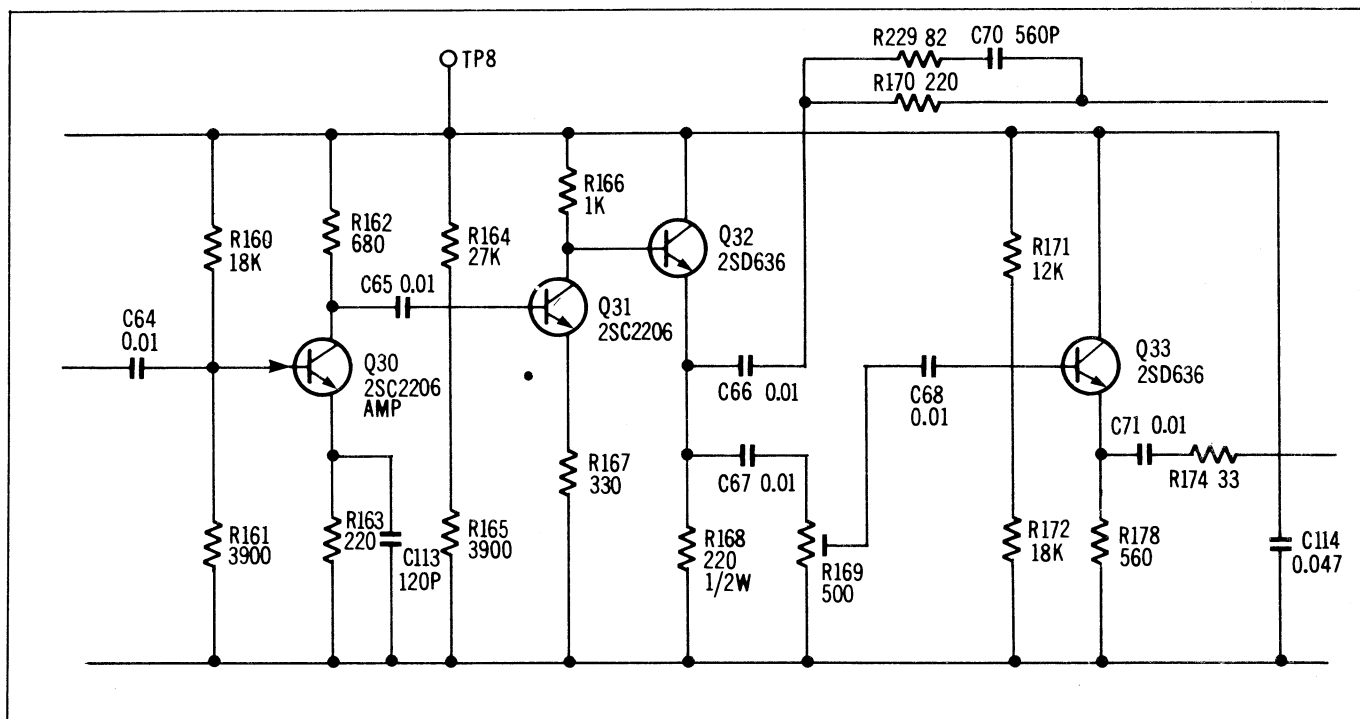


Figure 2-78

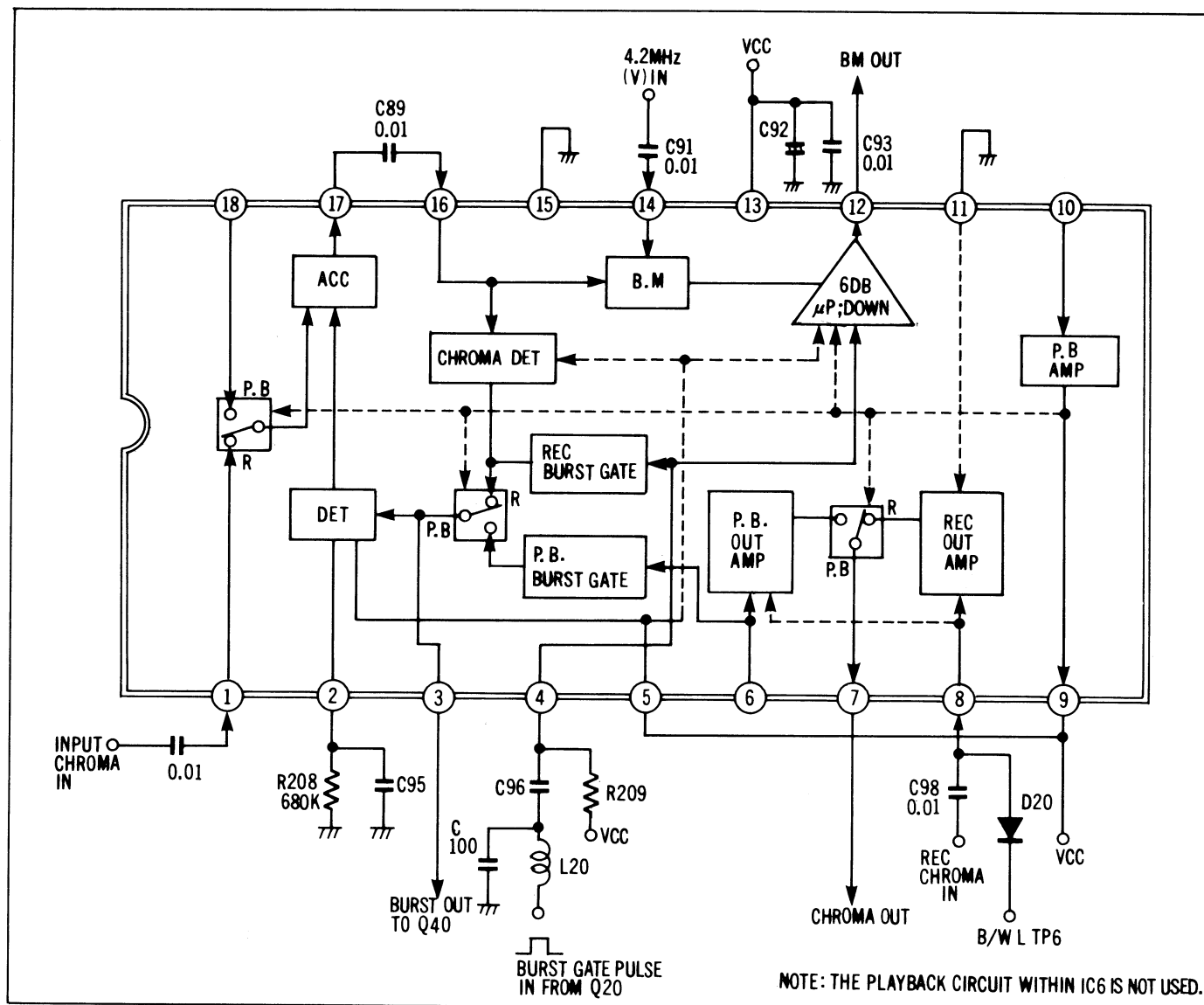


Figure 2-80

ACC Circuit

The ACC (Automatic Chroma Gain Control) circuit is analogous to the AGC stage for luminance. It automatically controls the gain for the chrominance signal so it is set to the proper level. Since the burst level is precisely dictated by NTSC standards, the burst portion of the chrominance signal is used to determine if the entire chrominance signal should be amplified or attenuated.

The chrominance signal is sent to IC6 Pin 1 where it passes through a REC/PLAY Switch and a variable gain amplifier (ACC Amp). Note that IC6 is used only in its Record mode. The output is fed back through a burst gate to a detector. The detected level sets the ACC stage gain. By applying a burst gate pulse at Pin 4, only the burst portion of the chrominance signal is allowed to pass.

The burst gate pulse is formed from the sync signal which was stripped from the video signal by the Reference Pulse Generator (Q20, etc.). A phase delay circuit (L20, C100, R101) delays the sync pulses enough so they coincide with the burst period.

The output of the burst gate, which consists only of the burst portion of the chrominance signal, is detected and converted to DC by the ACC Detector and C95. The output of the ACC Detector then controls the gain of the ACC Amp by applying negative feedback.

Thus, if the burst level is low, the gain of the ACC Amp is increased until the burst level is proper, and vice versa. The output of the ACC Amp is then sent to the balanced modulator for frequency conversion.

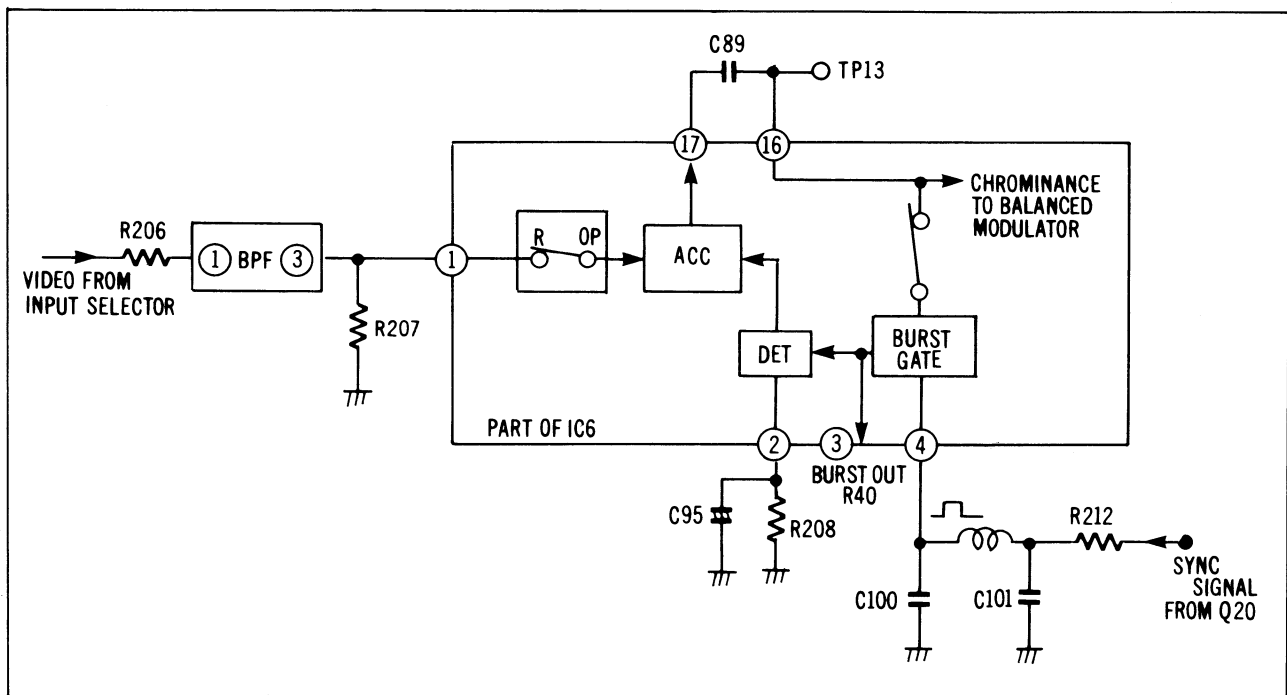


Figure 2-81

Frequency Conversion 3.58 MHz-688 kHz

The method used in all 3/4 inch series VCR's to record the chrominance information is to convert it in frequency from a band centered at 3.58 MHz to a band centered at 688 kHz. The converted signal is then mixed with the FM signal and direct recorded onto the video tape. Since the region below 1 MHz has been removed from the FM signal, there is no interference between the FM and the converted chrominance after they are mixed.

The frequency conversion is accomplished by sending the chrominance signal to one input of a balanced modulator. The other input to the balanced modulator is a 4.27 MHz sine wave signal generated by a 4.27 MHz crystal oscillator.

A balanced modulator is a device which mixes two different frequencies and produces an output containing neither input frequency.

The output contains both the sum and the difference of the two input frequencies.

In this case, one input is 4.27 MHz, and the other is 3.58 MHz. Therefore the sum is 7.84 MHz, and the difference 688 kHz. In this case, only the 688 kHz region is desired, so the output is sent through a low pass filter.

The balanced modulator is contained within IC6, and the low pass filter at the output is FL5 and 6. The 4.27 MHz crystal oscillator, adjustable with C72, is formed by Q34 and X1.

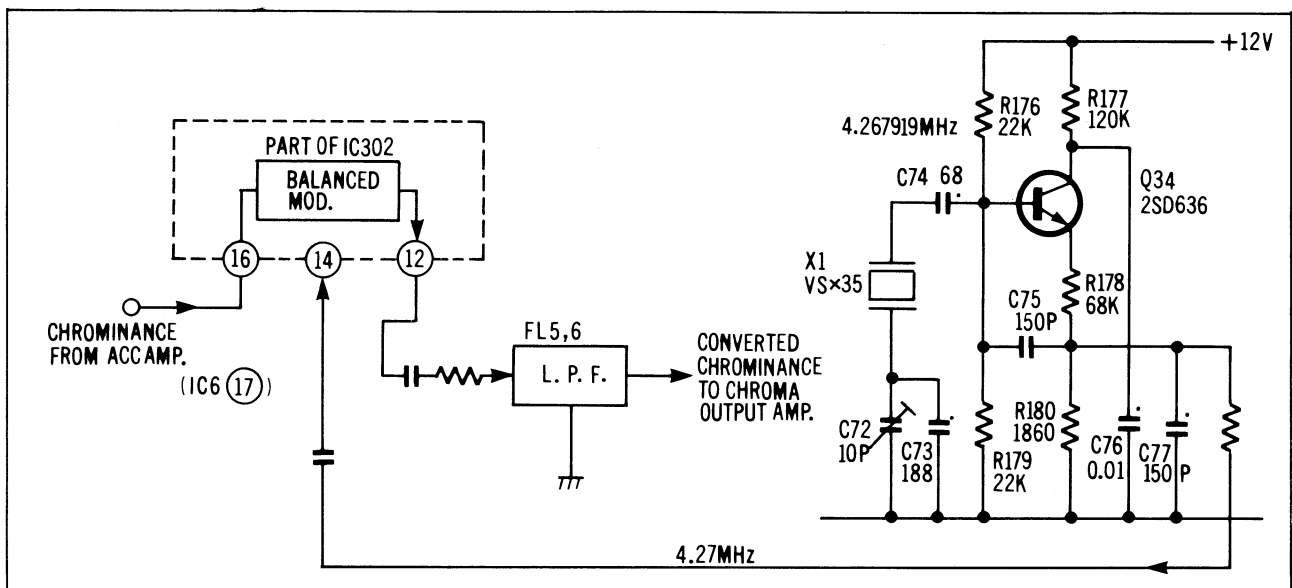


Figure 2-82

Chrominance Output Circuit

The 688 kHz chrominance from the low pass filter is sent to chrominance Record Amp Circuit inside IC6, which in addition to amplifying also provides on/off switching at its input stage, which is D20. At this point, the signal can be shunted to ground by D20 for the Black and White mode. Next the signal is buffered by Q38 through R195 (C. REC CURR.) and then this point is used for the E-E chrominance signal out and chrominance Rec Out Circuit.

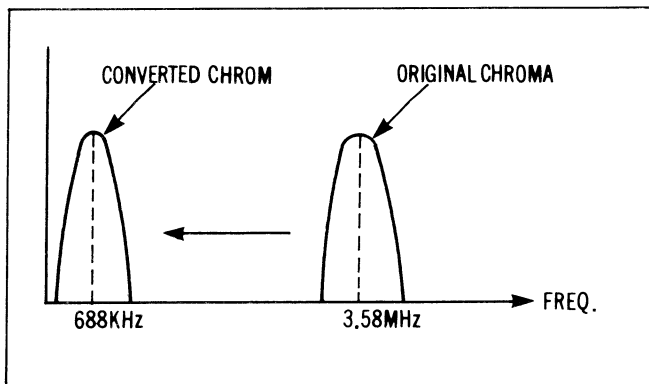


Figure 2-83

The Ceramic Trap Resonator ("CERAP") X2 performs as a 3.58 MHz filter. This filter eliminates any residual 3.58 MHz, since any leakage signal after the L.P.F. stage will beat with the FM luminance signal. After passing through the switch IC5 Pins 10, 11, the signal is buffered by Q38. The chrominance record signal can be shut off under two conditions. If the signal being recorded is black and white, a low is applied to Pin 12 of IC5 through D16 and D17, opening the switch. If the VCR is in the Dub mode, a low is supplied to Pin 12 of IC5 through D15, opening that switch. The Dubbing Chroma signal from connector P33 (6) is supplied to Pin 8 of IC5 through R187. Dubbing Color Rec signal is switched to the buffer Q38 by IC5-8, 9. Q36 senses the multiplexed DC from the source machine to assure a Chroma Dub signal is present. If the VCR is not making an actual recording with the tape running (Rec-Play Mode) a high is supplied to D19, Q37 turns on, and inhibits all chroma signal. IC5, 1-2 and IC5, 3-4 are used for logic (control) inversion switches.

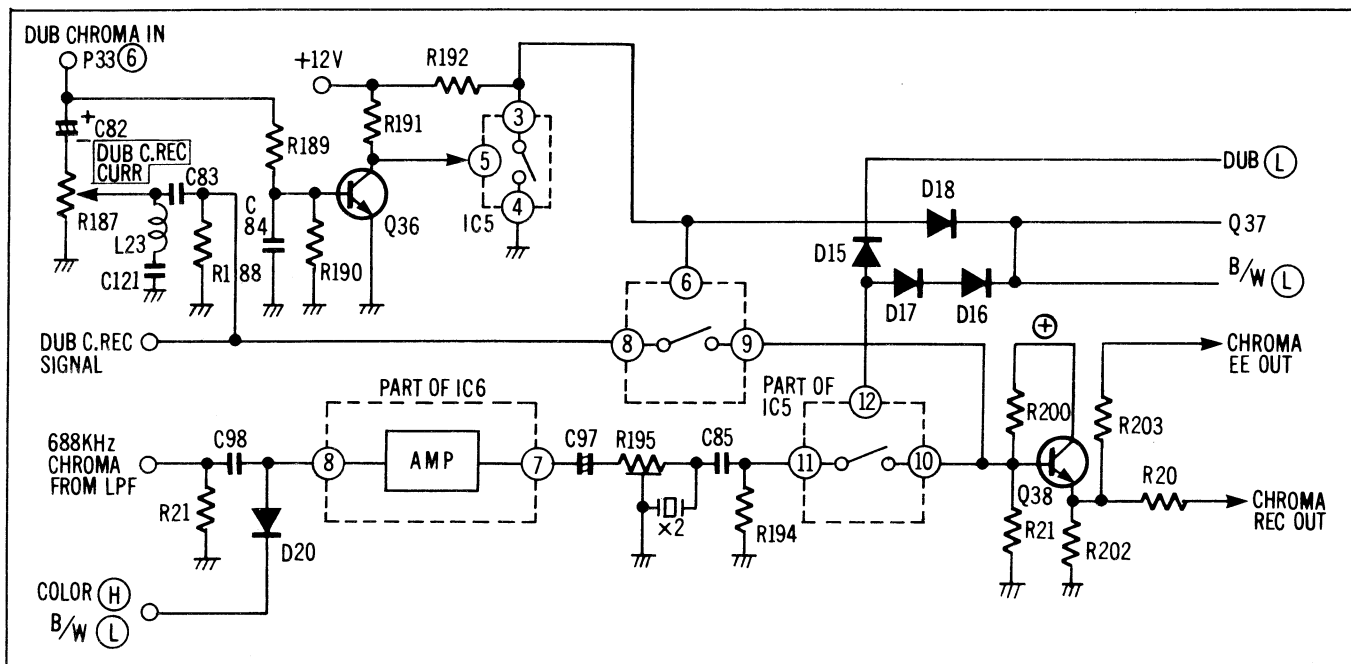


Figure 2-84

RECORD AMPLIFIER CIRCUIT (VEP0387)

This circuit provides the final amplification for both the Luminance FM signal and the down converted chrominance signal as well as resistive mixing just prior to application to the video heads for recording. There are two very similar sections (See Fig. 2-85).

Detailed Description

The FM signals from P311-1 are amplified by Q1 and passed to the buffer Q3 to be split and sent to drivers Q4 and Q5, which in turn are directly coupled to Q4 and Q7, the output stage.

Q2 mutes any output if the unit is not in the Record/Play mode.

Q8 amplifies the 688 kHz chroma from P311-5, and the buffer Q10 drives the output stage Q11, Q12. Q9 mutes the chroma output in the same fashion as Q2.

R23, 24 and R43, 44 form a mixing network with two outputs, one for each head, and these signals go to the Head amplifier board (VEP0539), relay RY1 (See Fig. 2-86).

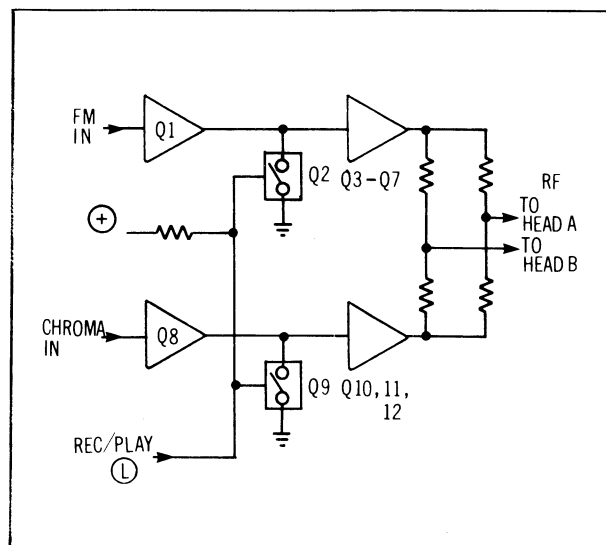


Figure 2-85

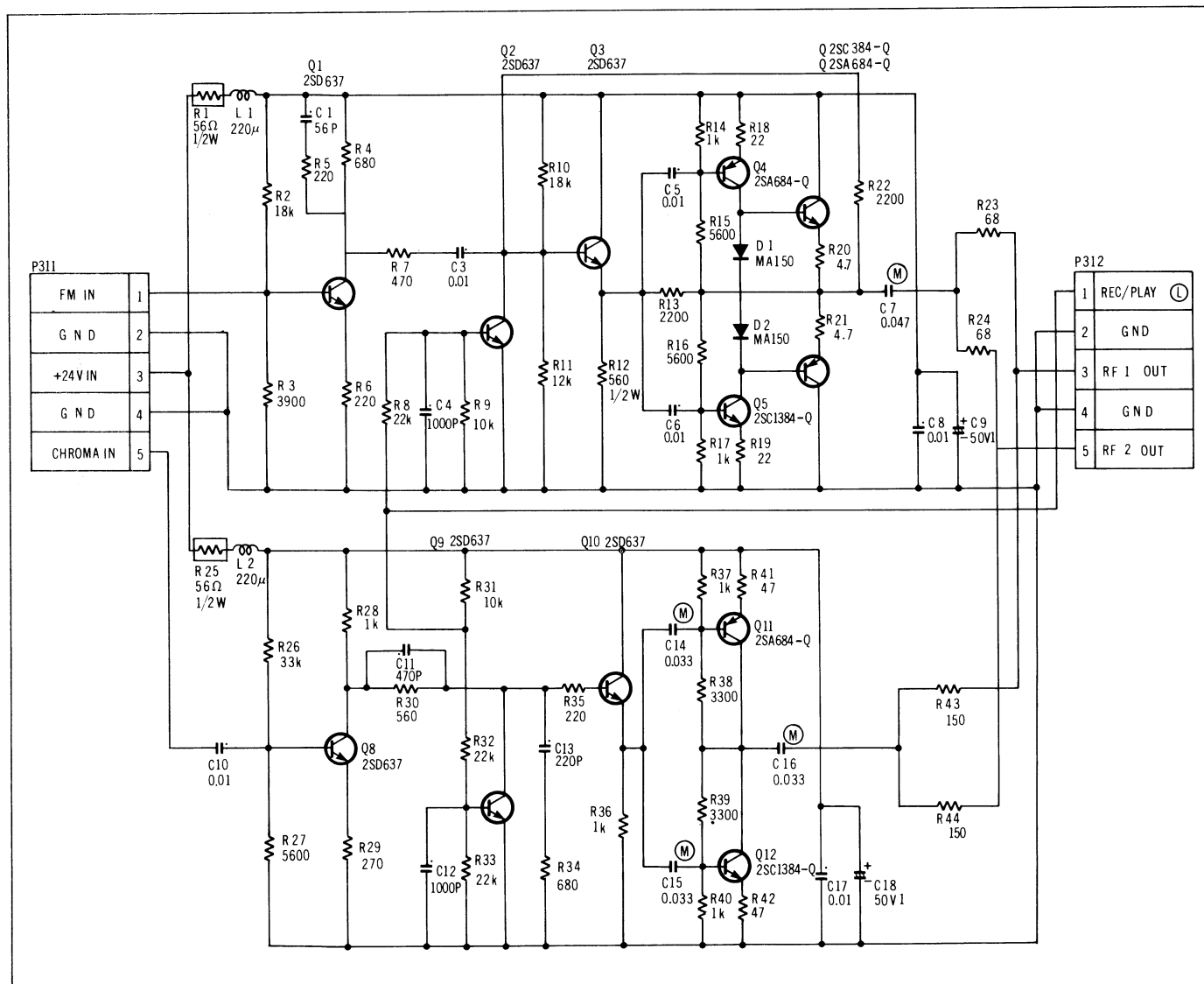


Figure 2-86

Head Amp. Circuit (VEP0531B)

During playback, the FM signal from the video heads and rotary transformers is supplied to the bases of Q1 and Q2 through transformers T1 and T2. Q1 and Q2 provide low noise gain for each head before amplification by the first stages of IC1. The peak frequency and Q of the equalization for each channel can be adjusted by resonance and feedback level.

C3 is the peak frequency adjust and R8 is the Q adjust for CH1. C4 is the peak frequency adjust and R15 is the Q adjust for CH2.

While one video head is on the tape, the other head is picking up only noise (See Fig. 2-87).

To eliminate this noise, the signal from the head which is not in contact with the video tape is switched off for that one-half revolution. For the next half revolution, the opposite head is switched off and the first head is switched on.

This is accomplished by the head switching pulse developed on the Servo Control board (VEP02100) which enters the Head Amp. at pin (7) of connector P54. This signal then goes to IC1 to control the output of CH1 and CH2. (See Fig.

This is possible because head cylinder and tape path are designed so that each head is in contact with the video tape for more than 180° (about 190°). Therefore, there is a small overlap region when both heads are in contact with the tape (See Fig. 2-88).

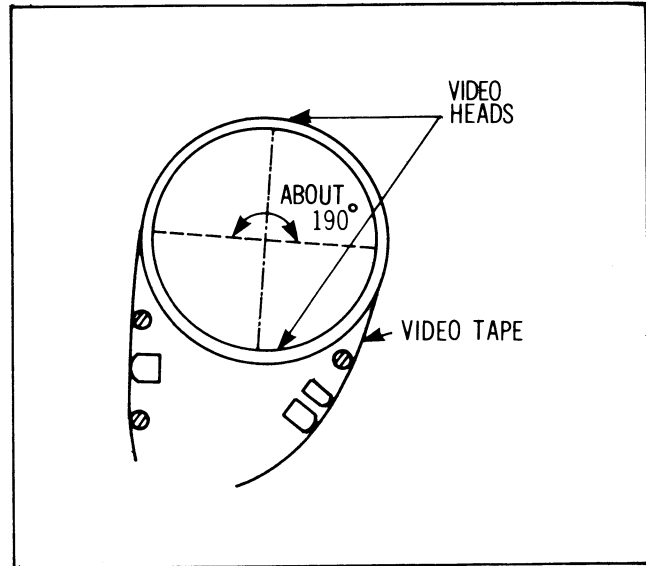


Figure 2-87

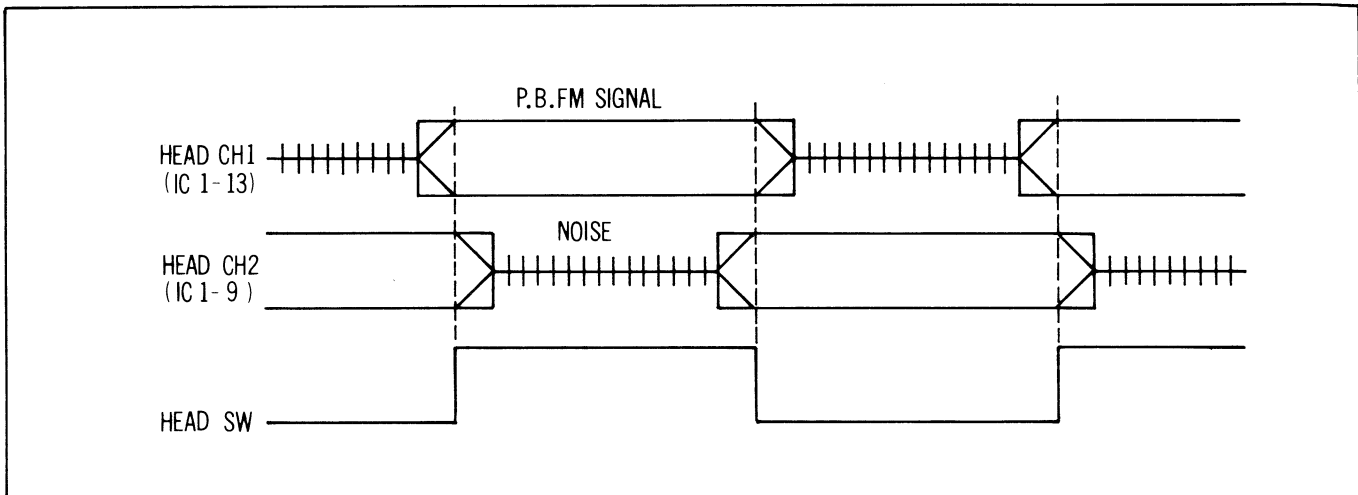


Figure 2-88

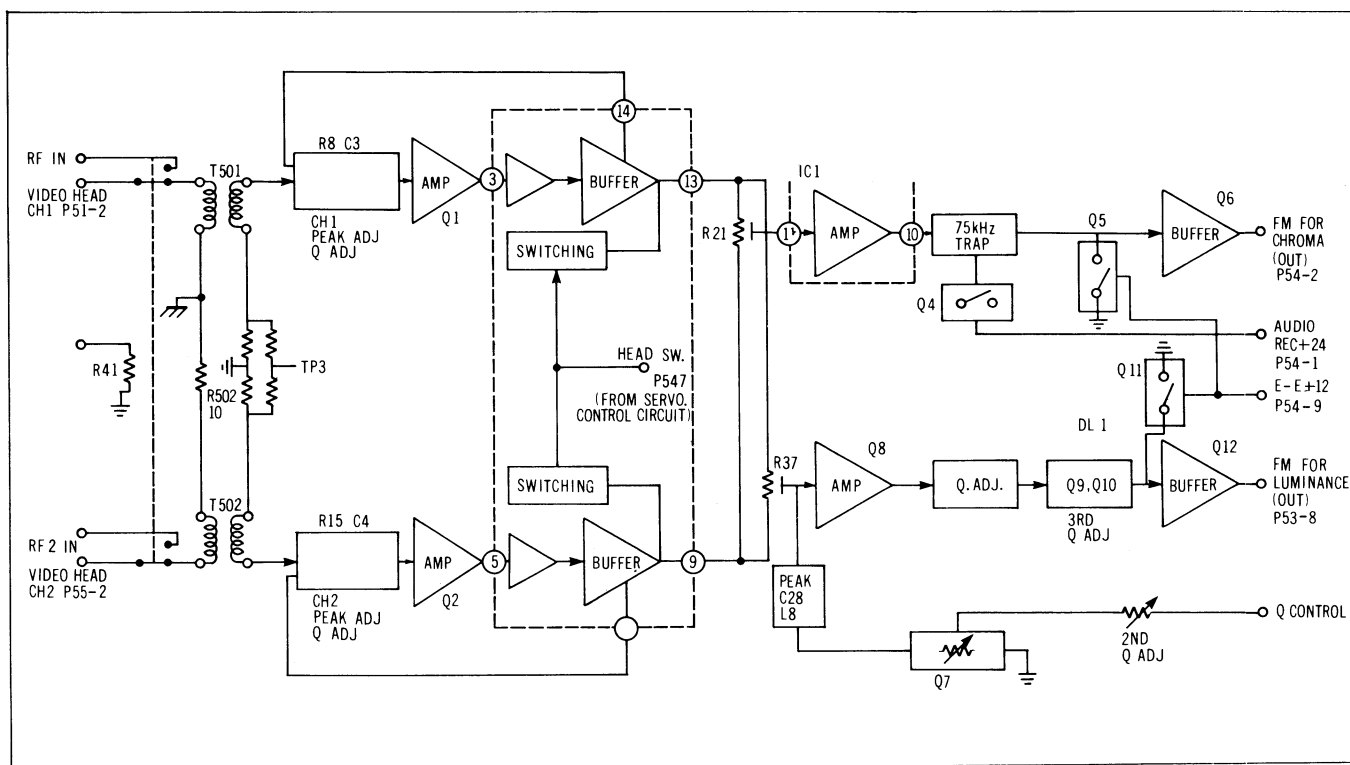


Figure 2-89

The phase of the head switching pulse is adjusted so as to be in the center of the overlap region.

The FM signal from each head, now amplified and equalized by IC1 and switched by the head switching pulse, is mixed twice, once by R21, and again by R37.

The signal from R21 is utilized for chrominance, and is adjusted so as to make the chrominance output level equal for both channels. The signal from R37 is utilized for FM (luminance) and is adjusted so as to make the overall FM level equal.

The mixed signal from R37 is then buffered by Q8. The overall equalization characteristic for the FM-Luminance signal is determined at this stage. The peak frequency is adjusted by C23 and the second Q is adjusted by R46, which sets the gate drive on Q7, used as a variable resistance element in series with the network L8/C28.

R46 is part of a resistive divider fed from the front panel "Q" control R6314.

The signal buffered by Q8 goes to delay line DL1 and a differential pair Q9, Q10. L9 and C37 is a 75 kHz trap to eliminate audio bias interference during audio dubbing. The signal is then sent through emitter follower Q12 to become the FM-Luminance playback signal.

The mixed signal from R21 is sent to amplifier IC1-10,11. Since this signal is used for the low frequency color information, there is a high frequency filter at this stage, (C14, L3). As a result, it is easier to later extract the color information. C20 and L5 form an adjustable 75 kHz bias trap which is enabled by Q4 during audio record. The signal is then sent through emitter follower Q4 to become the Chrominance playback signal.

Q5 and Q11 are switching transistors which block all signals and noise during the Record or E-E mode.

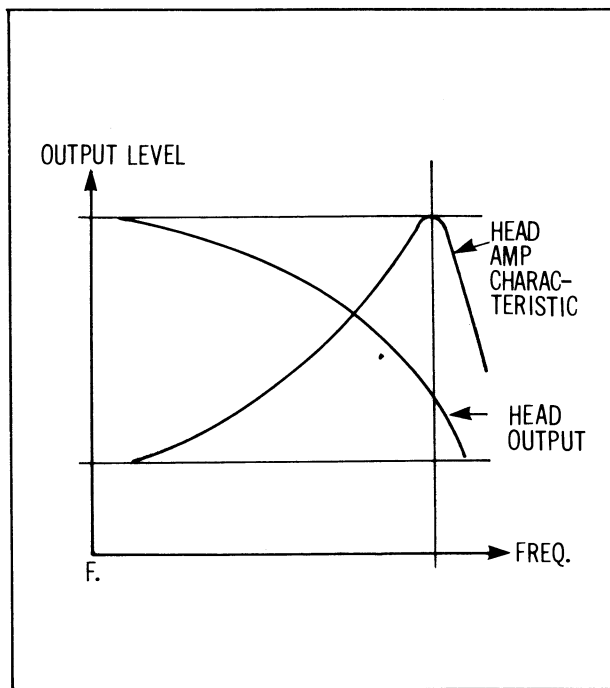


Figure 2-90

Video Playback Circuit (VEP0386)

General

During playback, separate luminance and chrominance signals come from the Head Amplifier to the Video Playback circuit.

While these signals both contain FM (luminance) as well as downconverted chrominance information, the FM for the luminance signal has had high frequency equalization. The FM for the chrominance signal has had very little equalization, making it much easier to extract the low-frequency chrominance information.

Luminance signal

The FM signal from the Head Amp. appears at Pin (4) of connector P301 during playback mode or Pin (1) of connector P301 (from Video Recording Circuit, VEP0385, P34 (2) connector) during the recording or (E-E) mode. In the color mode, the signal passes through a 1 MHz high pass filter and phase compensator, while for monochrome it is passed directly.

The signal selected within IC1 is supplied to the dropout compensator (DOC), IC5 (AN6331), and then its output is fed to the limiter, IC5. The limiter removes all traces of amplitude fluctuation in the FM signal which might be caused by noise pick-up, variations in tape output or tape contact, and the like. After limiting, the FM signal is restored to the video signal by the FM demodulator, consisting of a differentiator and a frequency doubler within IC5; a de-emphasis circuit (R140, C94) and a low pass filter (FL5).

The signal passes through the low pass filter to the luminance (Y) dub output and on also on to IC5.

The next circuit within IC5 is noise cancelling, which functions by selecting low level high frequency components and eliminating those components from the signal by cancellation. The chroma signal from the color Playback section is buffered and level set. Circuits contained within IC5 also perform chrominance mix and clamp the signal.

The signal is then amplified by two separate output stages to become the output video signals at P305 Pins (6) and (9).

The FM signal from the input stage (Q1) is also buffered for the FM output (for use with an external DOC) and for driving the tracking meter.

SMPTE time code, which may have been previously recorded on the time code address track (by other machines), will cause sync disturbance and is suppressed by circuitry on this board.

Sync separation is performed using the same signal as the Dub Y output.

Dropout Compensation

Occasionally during playback there is a loss of FM signal due to loss of contact between the video head and the tape, causing a loss or dropout of signal. This appears as a short line of noise in the picture. The dropout compensator, IC5, is employed to fill in this noise with signal.

When a dropout is detected, FM information stored from the previous line of picture (delayed by one horizontal line in Delay Line DL1) is inserted during the portion of missing information. The effect is to repeat part of the last good line of information twice, which is less objectionable than seeing the dropout. This is done in the luminance signal only.

Detailed Description

Luminance Signal

The FM luminance signal from the Head Amplifier or FM-EE from the Record Circuit is first amplified by Q1 (pre-amp), gain set (R5), and buffered (Q2) prior to splitting for the Color/Black and White Switch IC1. If the signal is black and white, after buffering and resistive dividing it goes through switch IC1-10 and 11 (See Fig. 2-91). If color, the buffer output goes to the high pass filters (FL1, 2) which eliminate the chrominance information (centered at 688 kHz) and allow only the FM luminance portion to pass.

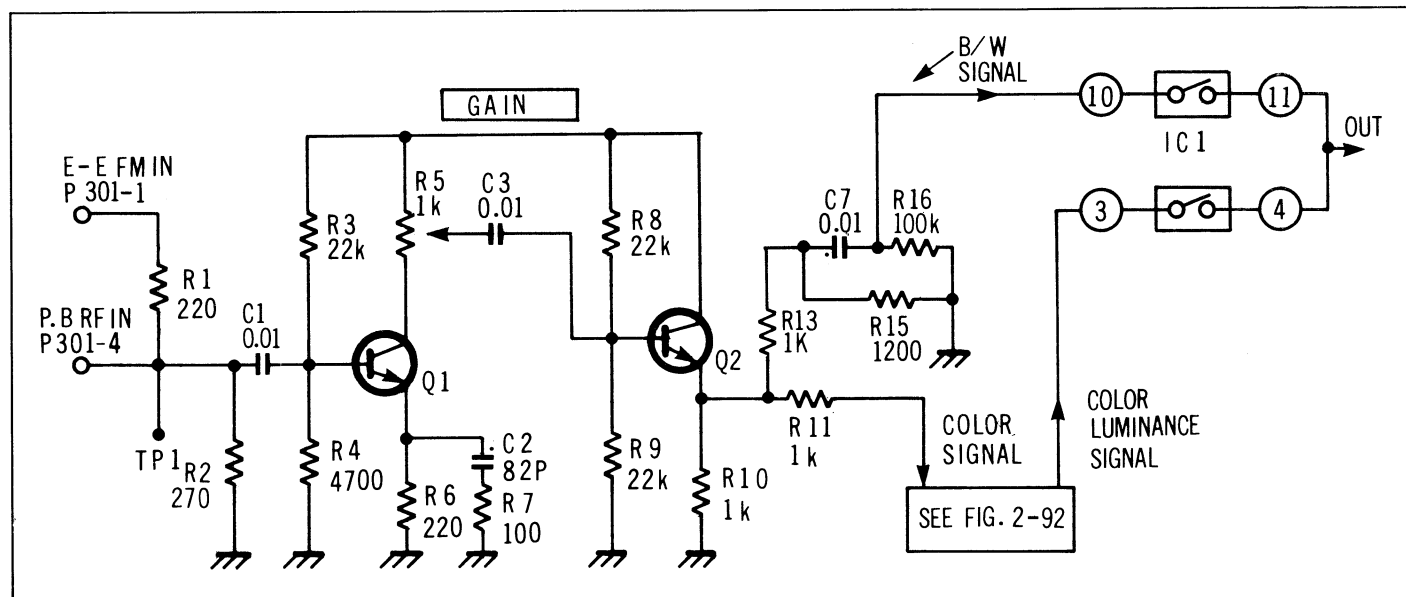


Figure 2-91

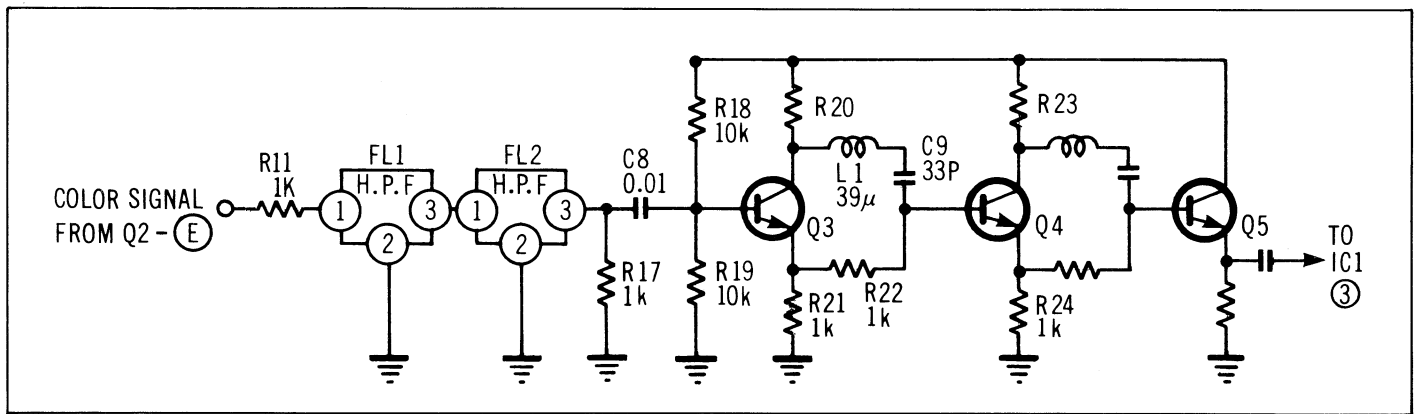


Figure 2-92

This signal is delayed for chroma matching by Q3 and Q4 and by the phase shift networks buffered by Q5, and passed to switch IC1-3, 4. (See Fig. 2-92).

The Color/Black and White switch functions as follows, driven by a signal from the color killer in the color playback circuit.

A Color (H) signal from Pin (5) P303 is inverted by IC4 (1), (2) and passed through NAND gate IC3-4 (5) and (6) to drive switches IC1-4 (3) and IC1 (8), (9). (See Fig. 2-93)

Since IC1 (8), (9) functions as an inverter, only one signal switch is on at any moment.

The output of the switching IC1 passes to a limiter (D11, D12 and Q6) to remove large amplitude fluctuations by feedback of inverted signal higher than the forward bias of the diodes. The signal passes to buffer (Q7) (See Fig. 2-94), and the output of this buffer goes to IC5 (7), (9) for dropout compensation.

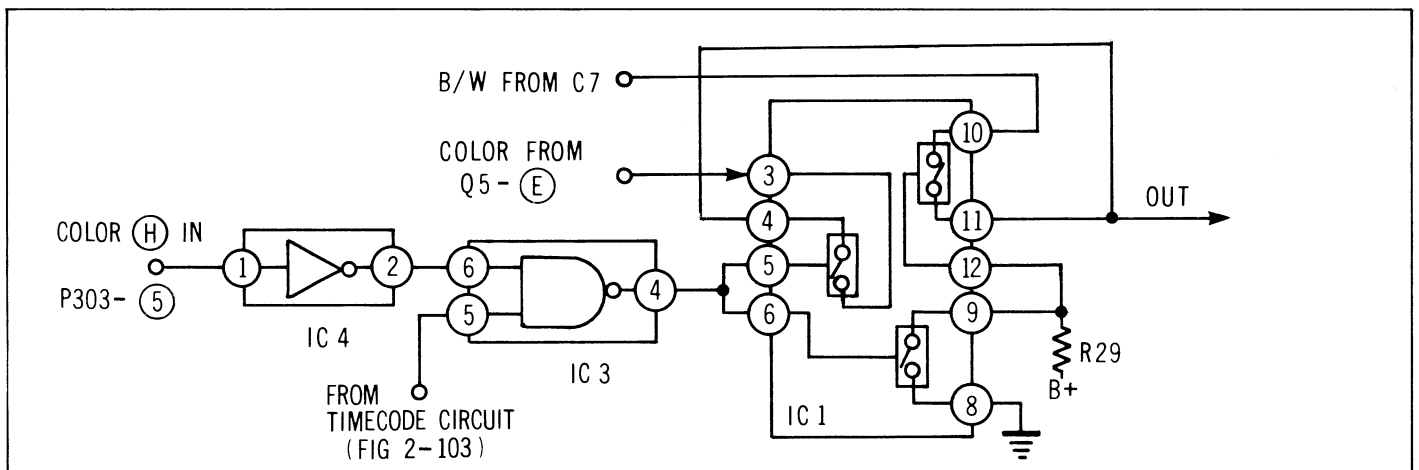


Figure 2-93

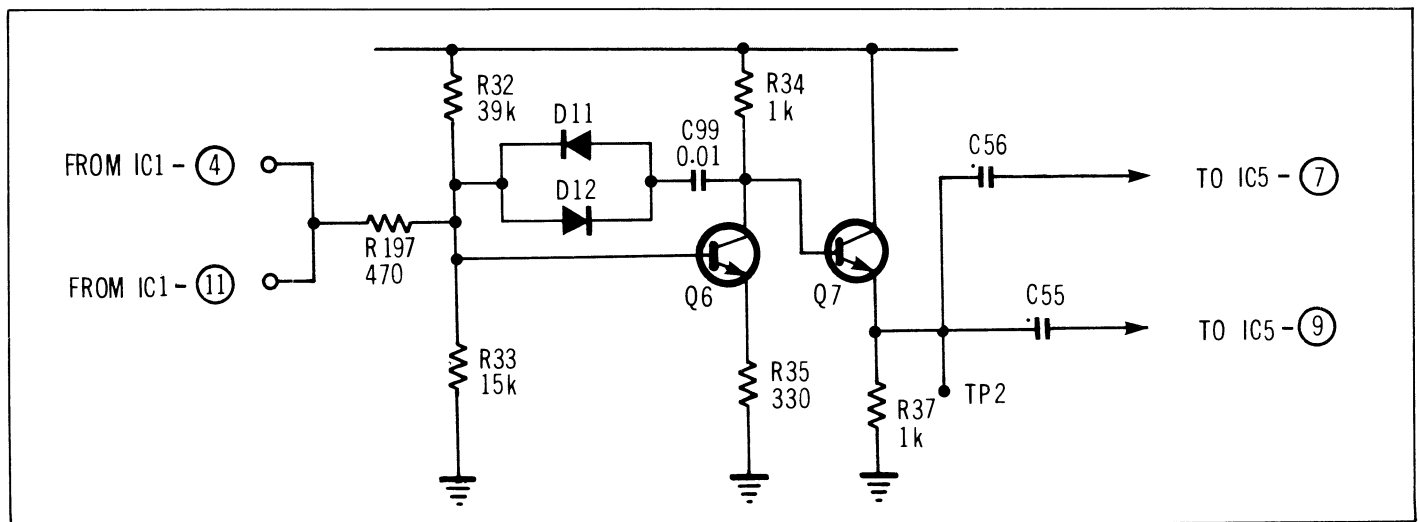


Figure 2-94

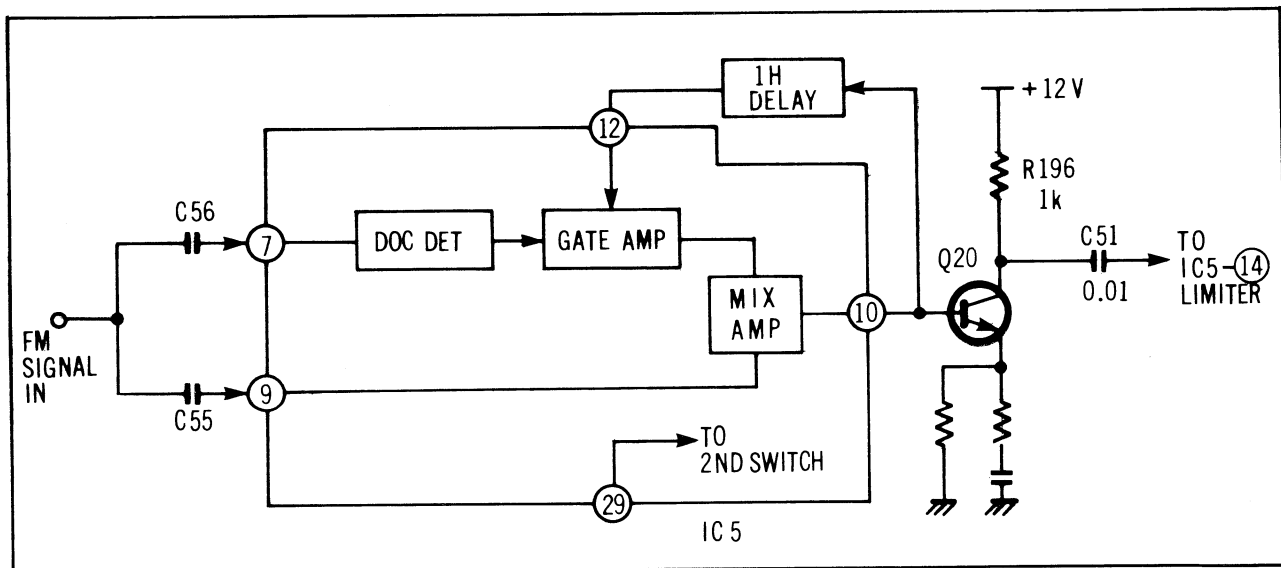


Figure 2-95

The buffered signal goes to Pin (9) through the mix Amp and out Pin (10).

The other input, Pin (7) allows the dropout detector to monitor the loss of signal. When no signal appears, signal from Pin (10) delayed one horizontal line by DL1 enters Gate Amp Pin (12) and comes out Pin (10).

Normally the delay line signal is inhibited by the Gate Amp except at the presence of a drop-out. Then the Mix Amp mixes the delayed signal in place of the missing direct signal. Note the color/monochrome switch in this circuit. Since both C/BW switches within IC5 operate based on the D.C. level of Pin (29) (chroma input) and the second switch section (at Pin (25)) is used, identical signal is fed to Pins (7) and (9).

In either case, the signal outputs are Pin (10), and Q20 (See Fig. 2-95).

The limiter removes any amplitude variations from the FM signal, thus removing a major source of playback noise.

The limiter consists of a series of four differential amplifiers contained within IC5-(14). Each differential amplifier partially clips the signal so that the output signal will be a squarewave of constant amplitude regardless of variations in the input signal.

If the limiter does not evenly clip the upper and lower portions of the FM signals, the output symmetry will be lost and RF carrier will appear after demodulation. The DC balance level is established by R110 (Limiter Balance).

After demodulation inside IC5, it is amplified by Q25 and supplied to a Low Pass Filter, FL5 (See Fig. 2-96).

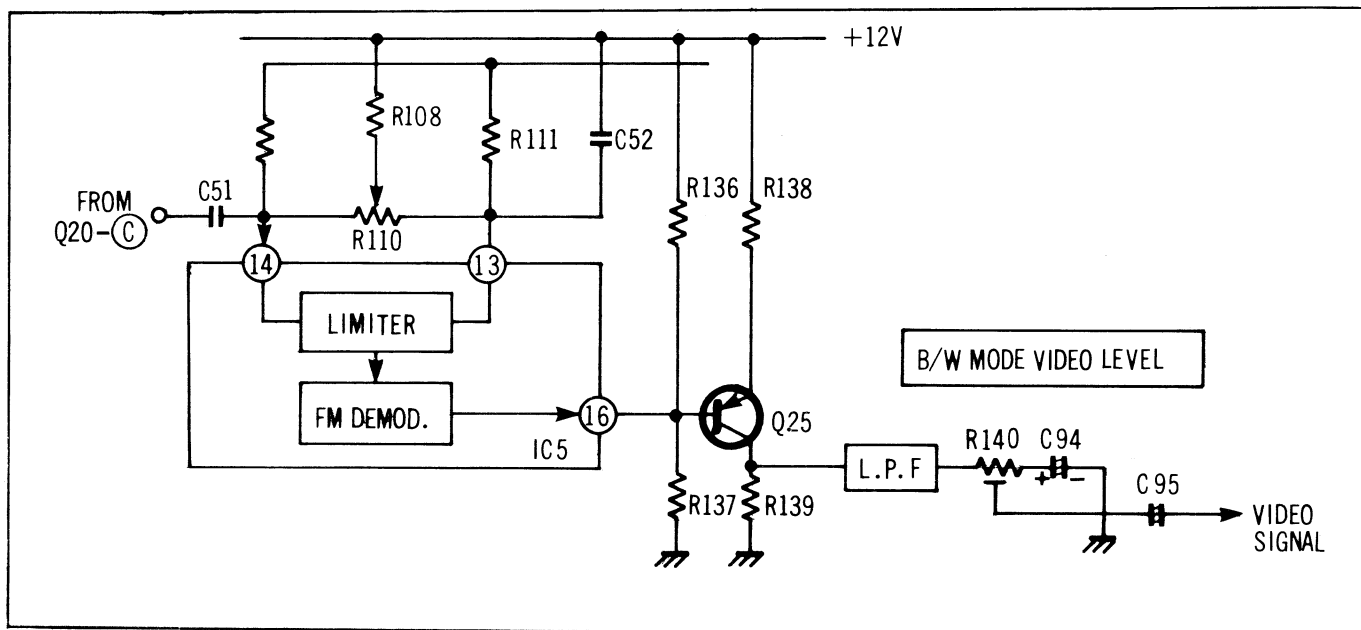


Figure 2-96

De-emphasis (26, R142, C73)

As was previously described, the video signal was pre-emphasized during recording. Therefore, it must be de-emphasized during playback to retain a flat overall frequency response. C73 and R142 form the de-emphasis network. This signal returns to IC5 (22) for more amplification from Q26. See Figure 2-97.

The output of the de-emphasis stage also goes to Q27 (amplifier) and output buffer Q28.

The video signal and D.C. component appear at Pin (3) of connector P306, dub luminance (Y). This luminance dub

signal does not have non-linear de-emphasis in order to maintain dubbing quality. (See page 1-96)

The video signal at IC5 Pin (22) is amplified and appears at Pin (24) of IC5 and at the B/W port of the following switch. If the video signal is Black/White, it goes to the noise canceller stage directly through this switch.

If the signal is color, it goes through the low pass filter, FL4, is level set by R130 and then appears at the noise canceller through pin (25).

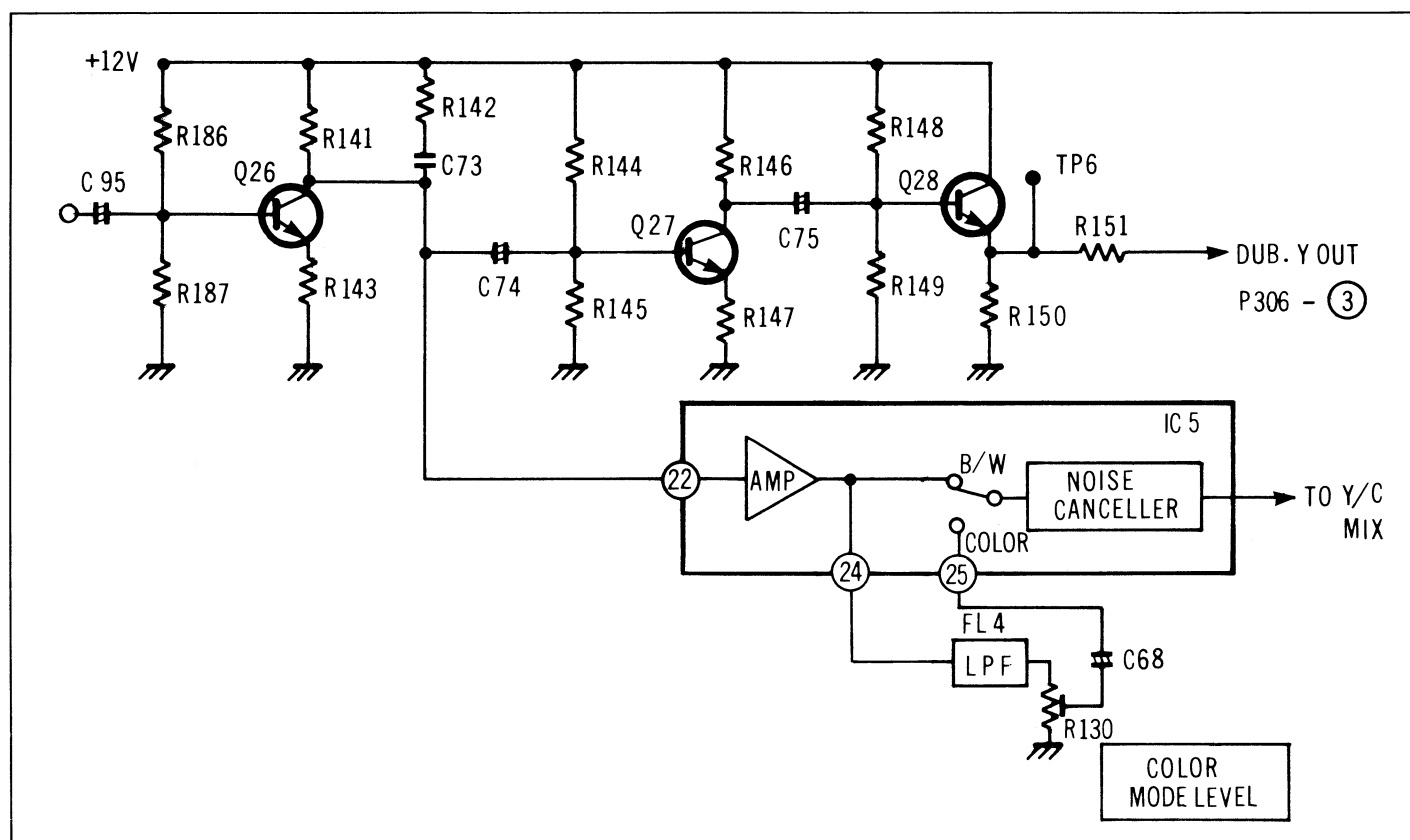


Figure 2-97

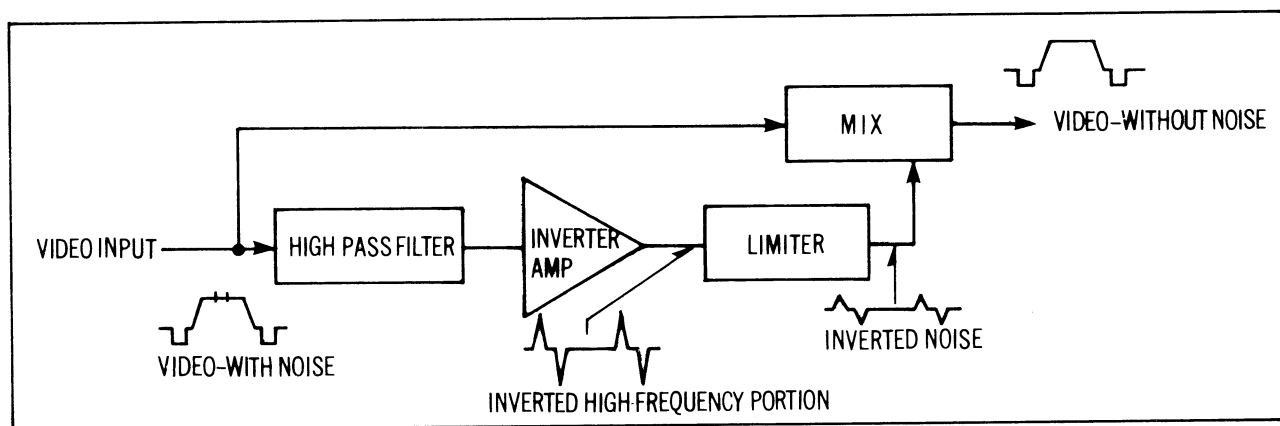


Figure 2-98

The noise canceller can improve the overall signal-to-noise ratio, since the noise lies in the high frequency region, and at low amplitude. This circuit extracts the high frequency very low amplitude portions of the video signal, which is mostly noise. This noise signal is algebraically subtracted from the wide band video signal, thus cancelling the noise. Some of the actual video signal is of course high in frequency and low in amplitude, and the noise canceller mistakes that for noise and removes it.

The signal boost done in the nonlinear emphasis (record) is reduced by this process, but some video information may be lost.

Subjectively, this high frequency, low level missing information is less objectionable than noise.

A simplified diagram of the noise cancelling process is shown in Figure 2-98.

The video signal enters IC5 Pin (25) from the low pass filter, is buffered and sent to the noise cancel summing amp (NOISE CANCEL) and to a High Pass stage (HPA).

This high frequency signal is then sent through a limiter (inside IC5) and appears at Pin (20).

This signal (inverted noise), is coupled through C70 back to the summing amp IC5, (27). The output of the noise cancel stage goes internally to the luminance/chroma mix stage. The Chrominance signal from P304-(5) is amplified and buffered by Q18 and Q19 and sent to IC5 pin (29) to be added to the noise suppressed Luminance (See Fig. 2-99).

The composite video signal is then sync tip clamped by C60 and a clamp stage within IC5, goes through the E-E/V-V switch and appears at pin (2).

The emitter follower Q38 also sets the D.C. bias on the signal sent to the output circuits Q34, Q35 and Q36, Q37, video out (2) for TV (P305-(6)), video out (1) for line (P305-(9)). This bias will control the defferential gain of the output stages.

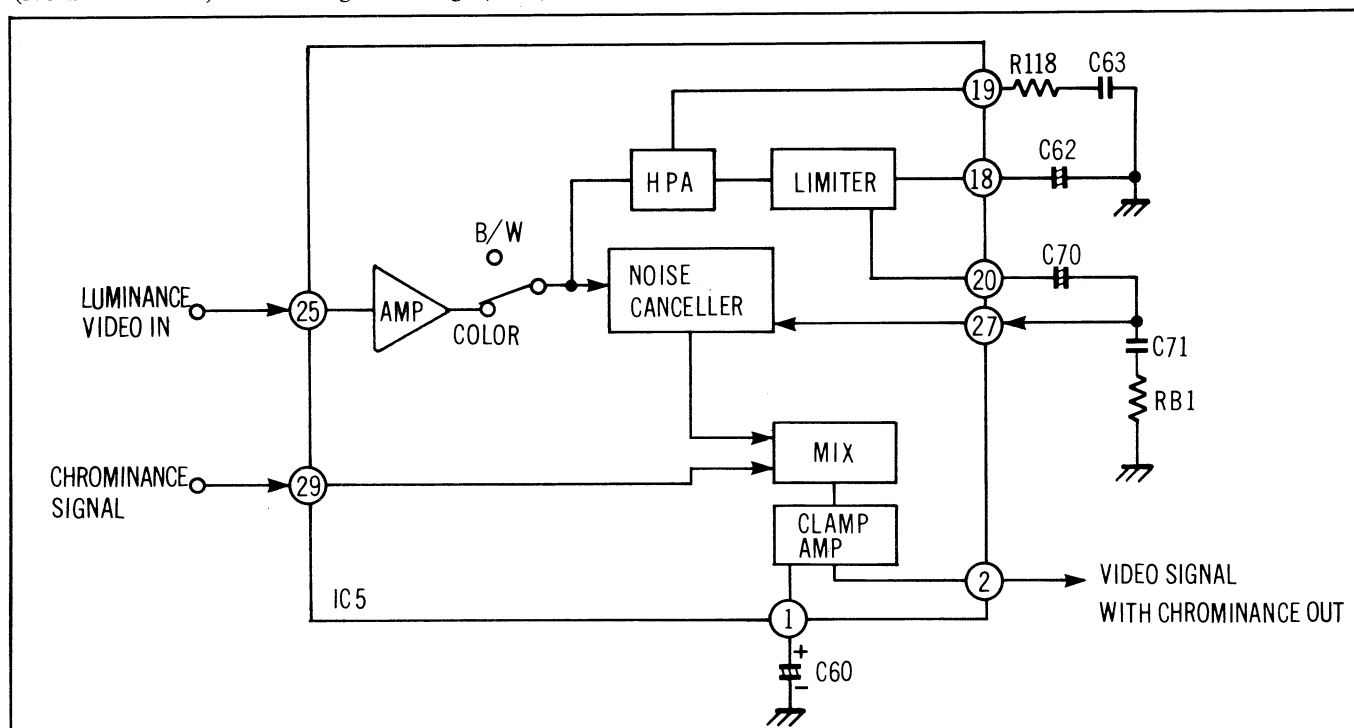


Figure 2-99

DUBBING

The NV9600 has provision for a special signal transfer process called dubbing. This is designed to interconnect two like video recorders so a tape may be copied from one to the other. While this could be accomplished with the normal video and audio signals, the special inputs and outputs produce a copy that is significantly better in quality, especially in resolution and chroma signal to noise.

The transfer signal is carried in a special cable through special 7 pin connectors.

As can be seen in Fig. 2-100, the connectors carry the luminance signal and the chrominance signal separately. The luminance signal is the brightness (or black and white) component of the picture, and the chroma (or color) signal in this process is the 688 kHz which was down converted from 3.58 MHz for recording. At the time of playback, this signal is processed minimally and sent to the recording unit, where it also requires little processing. This simple path saves quality.

Both of these signals carry a DC voltage level as well as actual signal. This voltage (about 6 ± 2 volts) is used for slightly different purposes.

The voltage with the luminance signal activates the 7 pin connector input when the unit is in the DUB mode. If this voltage is not present, it signals that no playback unit is used, and the line input is activated.

The voltage carried with the chroma signal is used to convey the color/monochrome status of the playback unit.

This is required because the recording unit color sense circuit operates at 3.58 MHz, and does not recognize the 688 kHz.

If the voltage is not present, the record unit operates in the black and white mode. See Fig. 2-130, Page 111.

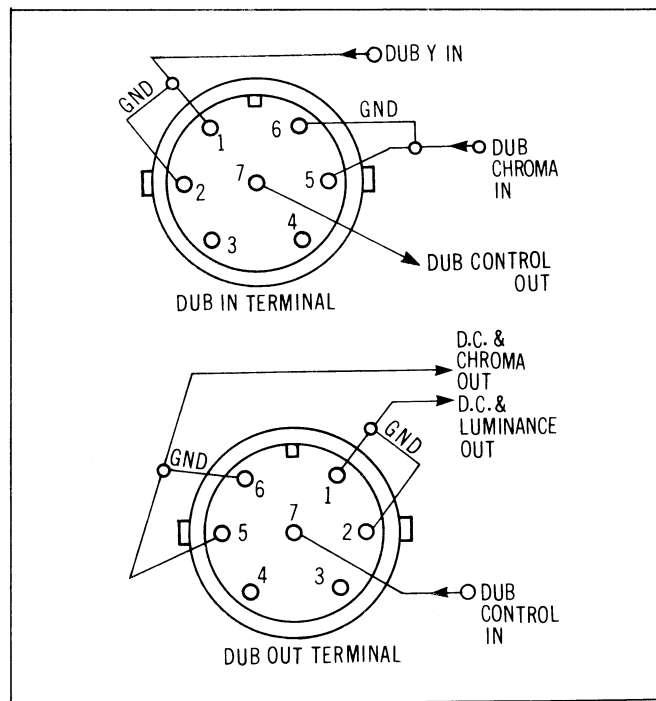


Figure 2-100

T/C signal Eliminator Circuit

When a tape recorded with SMPTE Time Code on the time code Address Track is played the Time Code causes a beat to appear during the Vertical Sync portion of the video signal.

Circuits are incorporated in the unit to recognize the time code signal and to eliminate the beat. The Time Code signal is 80 bits for every frame on the Address Track, which is crossed by the video heads during the playback of the vertical interval. (See Fig. 2-101)

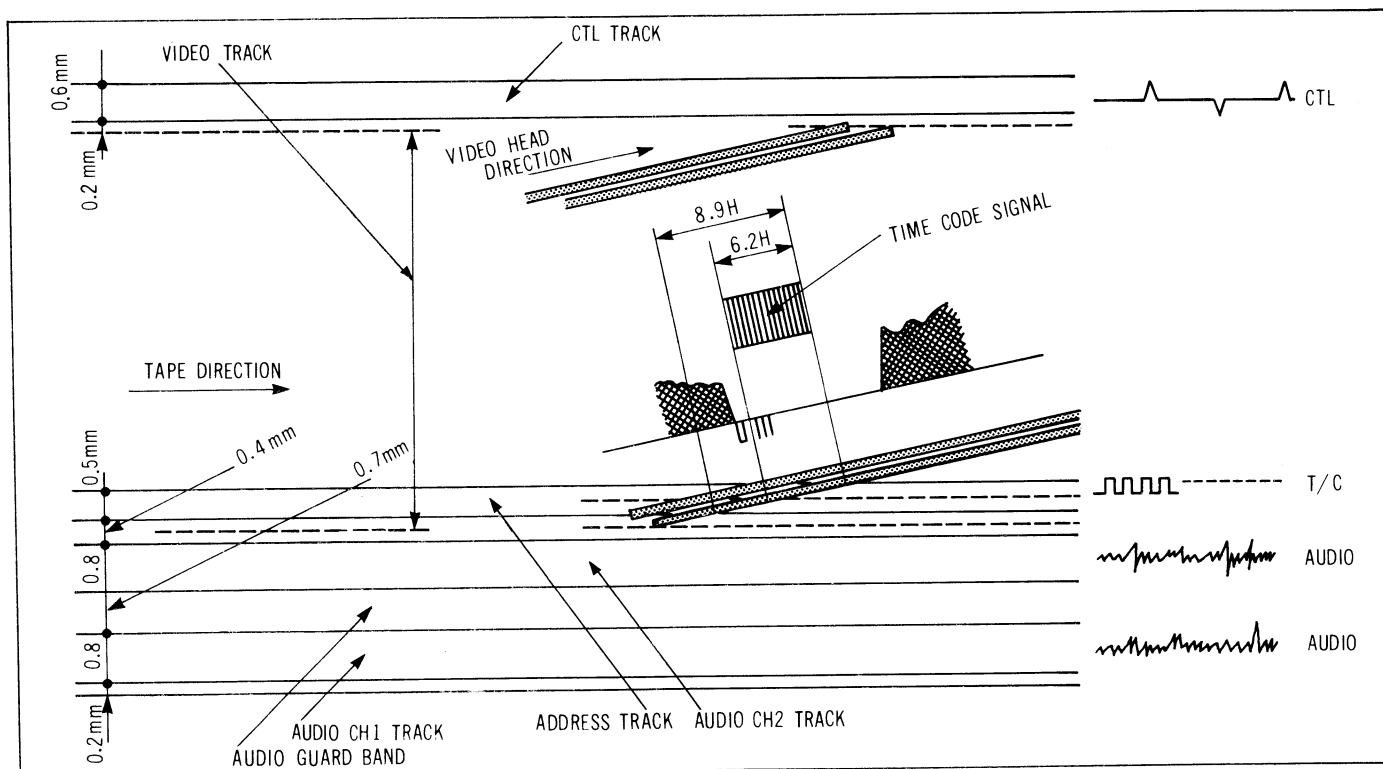


Figure 2-101

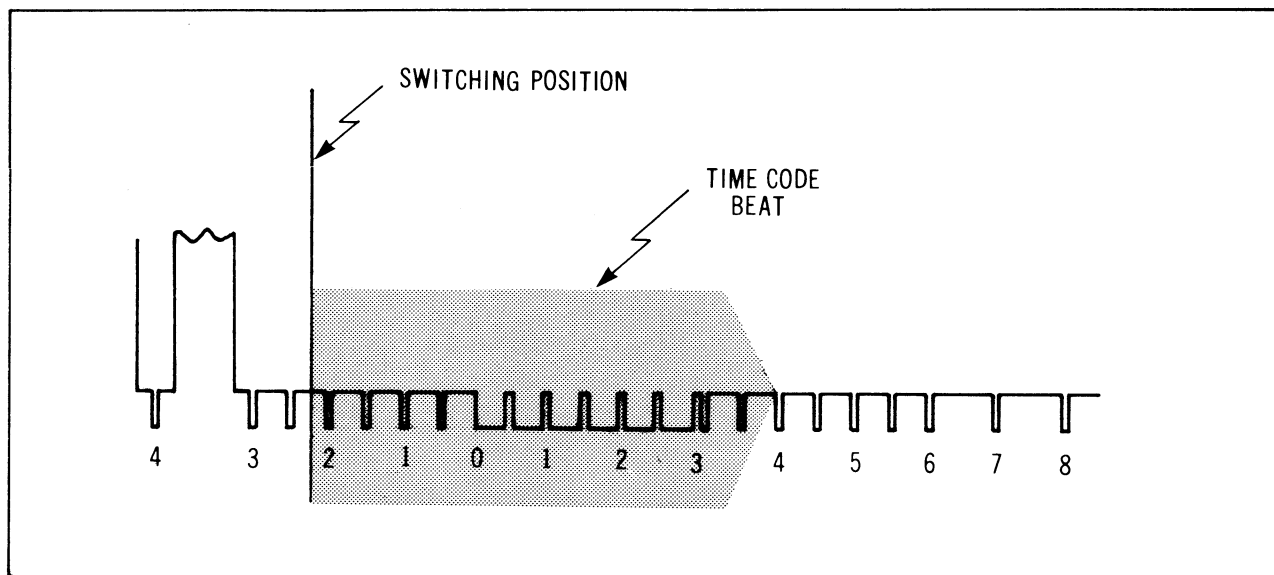


Figure 2-102

The Time Code Signal digitally indicates the absolute address (in hours, minutes, seconds and frames) of each frame, for use during editing. The interference appears for a 6.2 H period, beginning at the switching point (See Fig. 2-102).

The P.B. RF signal from P301-(4) is supplied to a Low Pass Filter (L5, L6, C23, C24 and C25) through Q1, Q8 (Amp) and Q9 (Buffer). This filter network passes signals under 200 kHz, which is primarily the time code signal. (See Fig. 2-103 and 104).

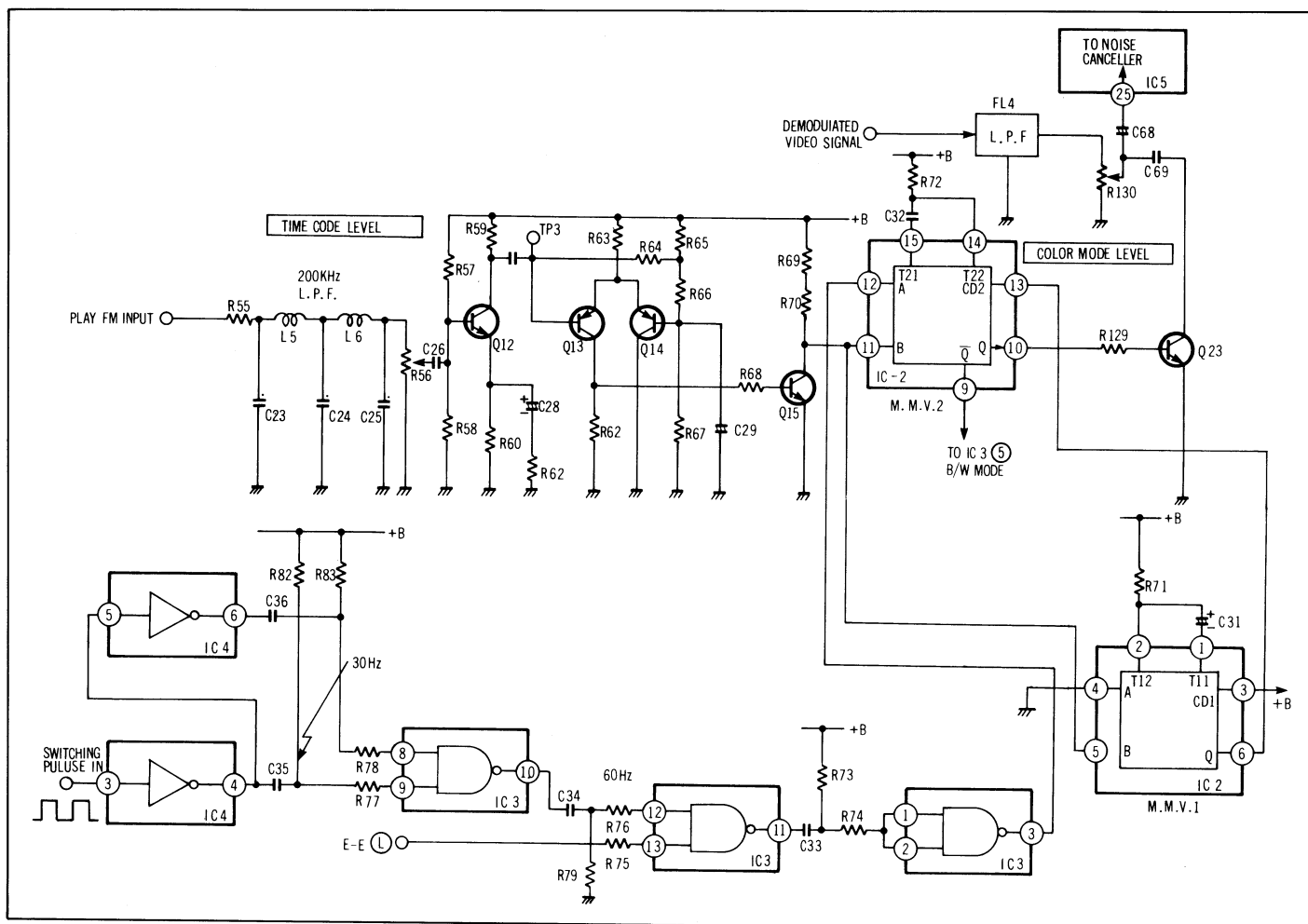


Figure 2-103

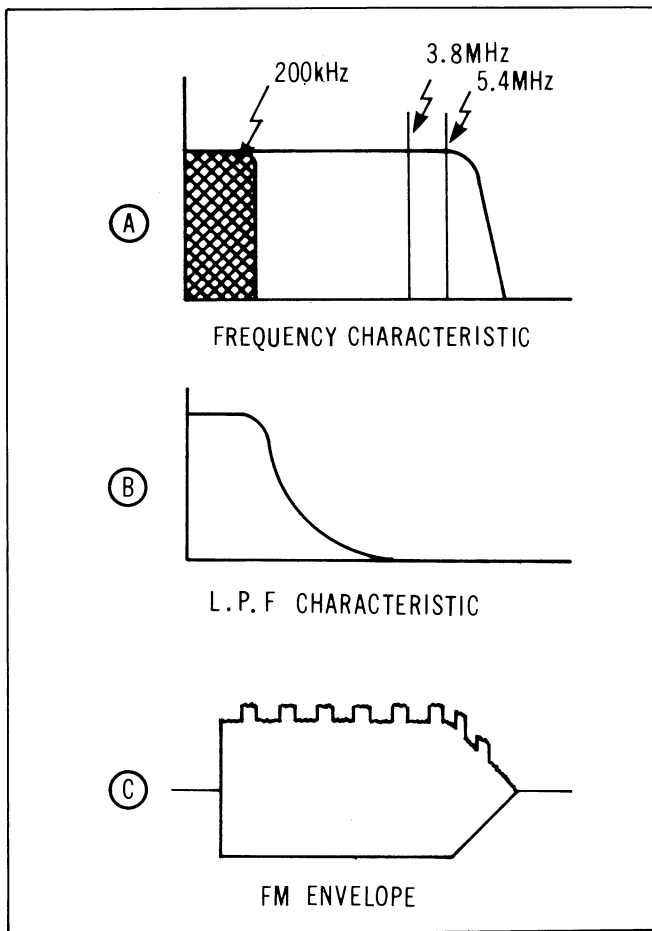


Figure 2-104

This is amplified by Q12 (Fig. 51-(c), TP3) and Q13, Q14 (Differential Pulse Amp).

A negative pulse from inverter Q15 triggers MMV1 (IC2-(5)) for a period of 40 milliseconds. The 40 msec period is determined by C31 and R71.

IC2, a μ PD 4528, is a dual, retriggerable, resettable multi-vibrator (See Fig. 2-105 and 106).

Since the 40 millisecond period is longer than the frame rate (33.8 ms), if time code is present in subsequent passes of the heads, the MMV will remain triggered. The Q output remains high to enable MMV2, since IC2-6 goes to IC2-13, the clear input (CD2).

The MMV-2 delay time is 200 μ sec, determined by C32 and R73.

One output of M.M.V2 (IC2 Pin (10)) turns Q23 on during the time code signal period to filter the 4.5 MHz r.f. beat through C69 (See Fig. 2-103).

The second output goes to IC3-(5) to switch to the black and white mode during time code track crossing.

Note that this MMV2 is triggered by two sources, the time code and the head switching pulse.

Since MMV1 recognized the time code by being triggered, and since the track arrangement means the head just following head switching will have the time code disturbance, MMV2 is first triggered by the headswitch point, then retriggered by the time code. When the time code has passed, MMV2 returns to the normal state.

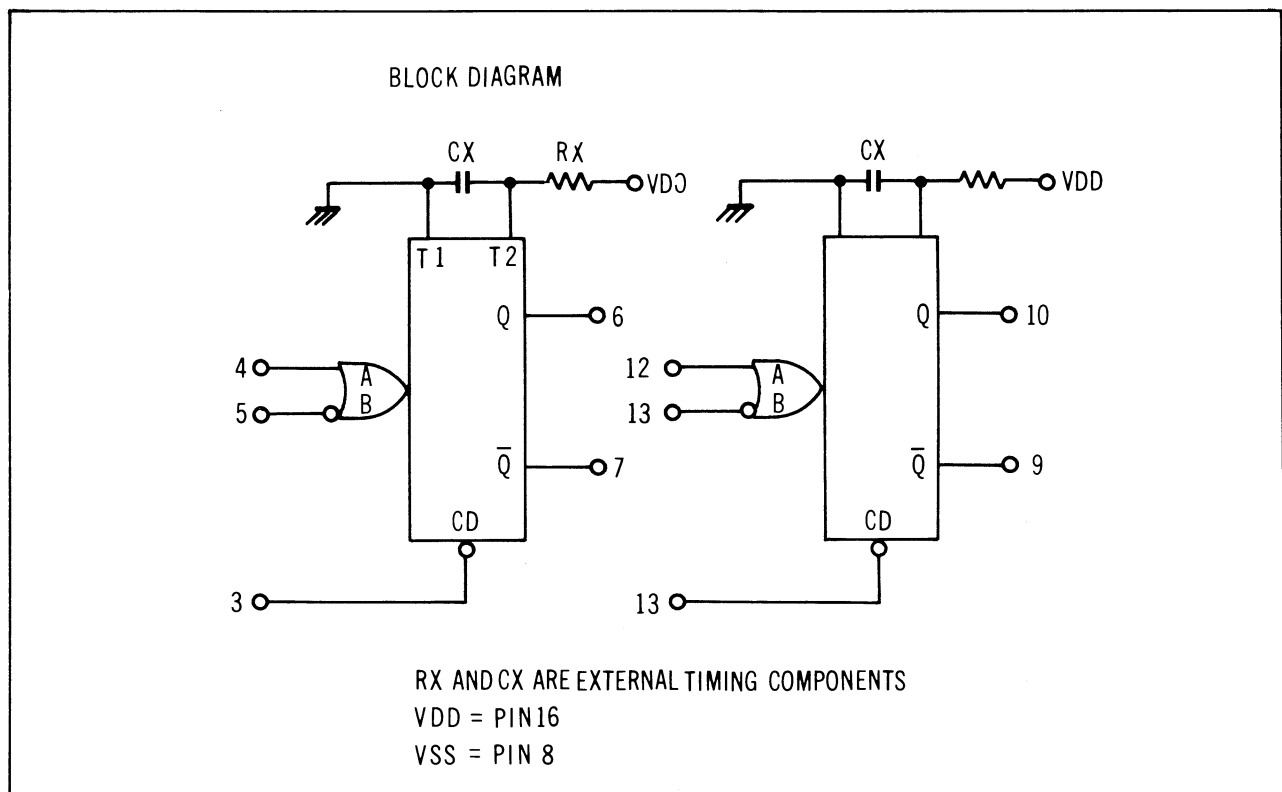


Figure 2-105

The 30 Hz head switching pulse is supplied to IC3 Pin (9), inverted and differentiated by C35 (Fig. 106-(C)). The inverted switching pulse at IC4-(4) (Fig. 106-(B)) is again inverted and differentiated by C36 (See Fig. 106-(E)). As a result of the inversion and dual differentiating circuits, a 60 Hz pulse at pin (10) of IC3 (Fig. 106-(F)) is formed coincident with the start of the time code signal period. This 60 Hz pulse is applied to pin (12) of IC3.

A high level is applied to pin (13) of IC3 only during the "Not E-E" mode, so a 60 Hz negative pulse appears at pin (11) of IC3 only during the playback mode (See Fig. 106-(1)).

This pulse is differentiated by C33, narrowed and inverted at IC3 (3) and triggers IC2 (12), MMV-2.

Since the time code appears at MMV-2 input B (IC2-(11)) MMV-2 is retriggered until the end of the time code period.

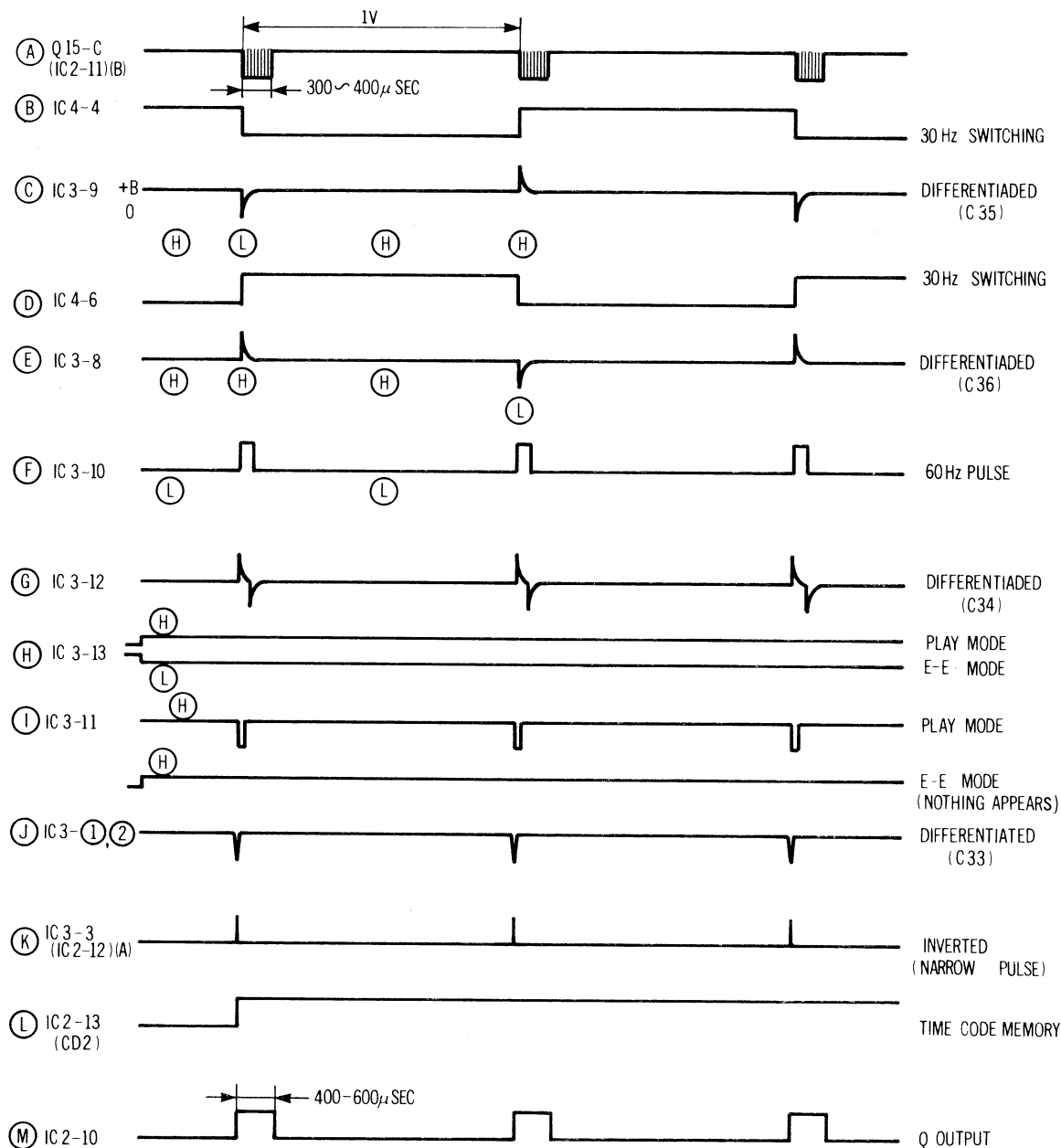


Figure 2-106

Horizontal Sync Pulse Processing

Horizontal (H) sync signal is separated and reformed from demodulated video taken from the emitter of Q28 (TP6). Emitter follower Q29 feeds the Horizontal sync separator Q30.

Note that all of the sync pulses are stripped from the video signal including the equalizing pulses of the vertical interval, which occur at a rate twice the horizontal frequency. (The spacing between equalizing pulses is equal to one-half a full horizontal line.)

The positive going H sync and equalizing pulses trigger a monostable multivibrator (IC6-(1) -(7)) whose period is greater than 0.5 H (40 μ sec) and less than 1 H, determined by C78 and R159. The output of IC6 pin (6) (Fig. 2-107) goes negative when triggered.

Because its duration is greater than 0.5 H, it fails to trigger on every other equalizing pulse in the vertical interval.

Therefore every positive going transition of the output occurs in step with horizontal sync timing. See Figure 2-108. In order to re-create the pulse width of the original horizontal sync, the signal at pin (6) is sent to another monostable multivibrator, IC6-(9) - (15), whose duration, as determined by C79, R160 and R195, corresponds approximately to the horizontal sync duration, 4.5 μ sec.

This horizontal sync signal at pin 10 of IC6, after being buffered by Q31, is used as the H sync signal for the color playback AFC comparator circuit, burst gate generation and for the Frame Detection Circuit.

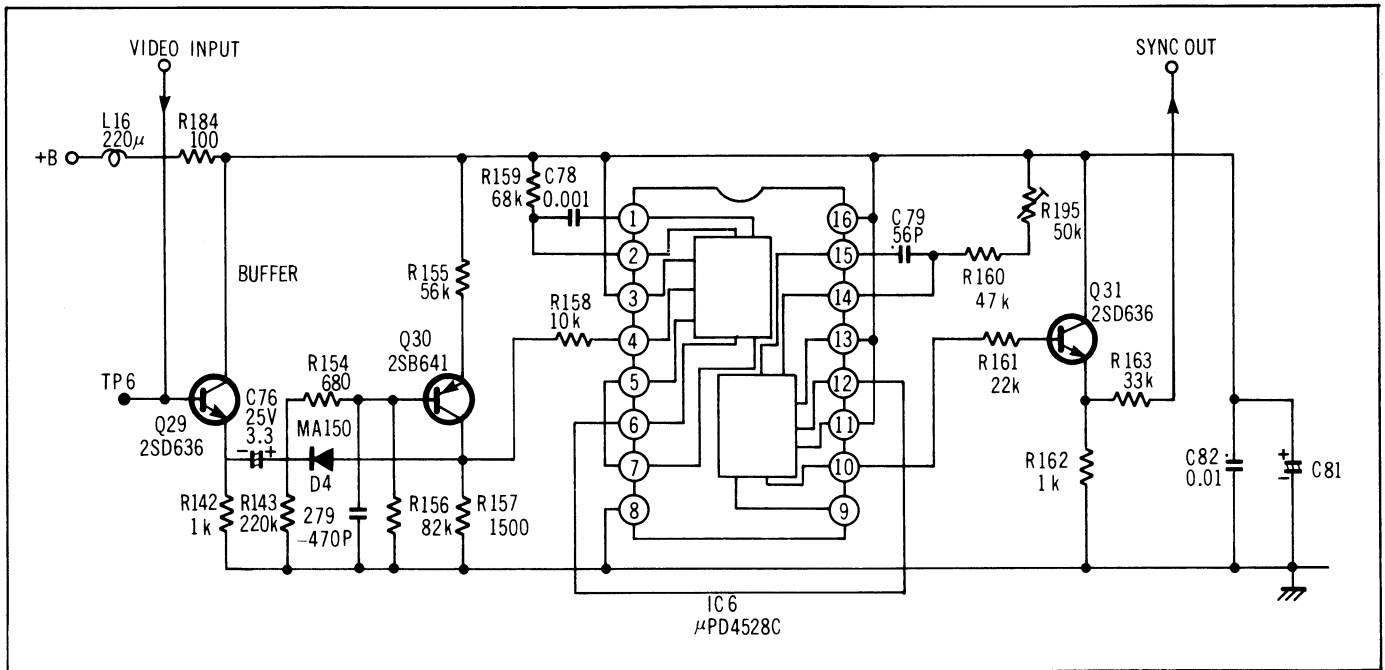


Figure 2-107

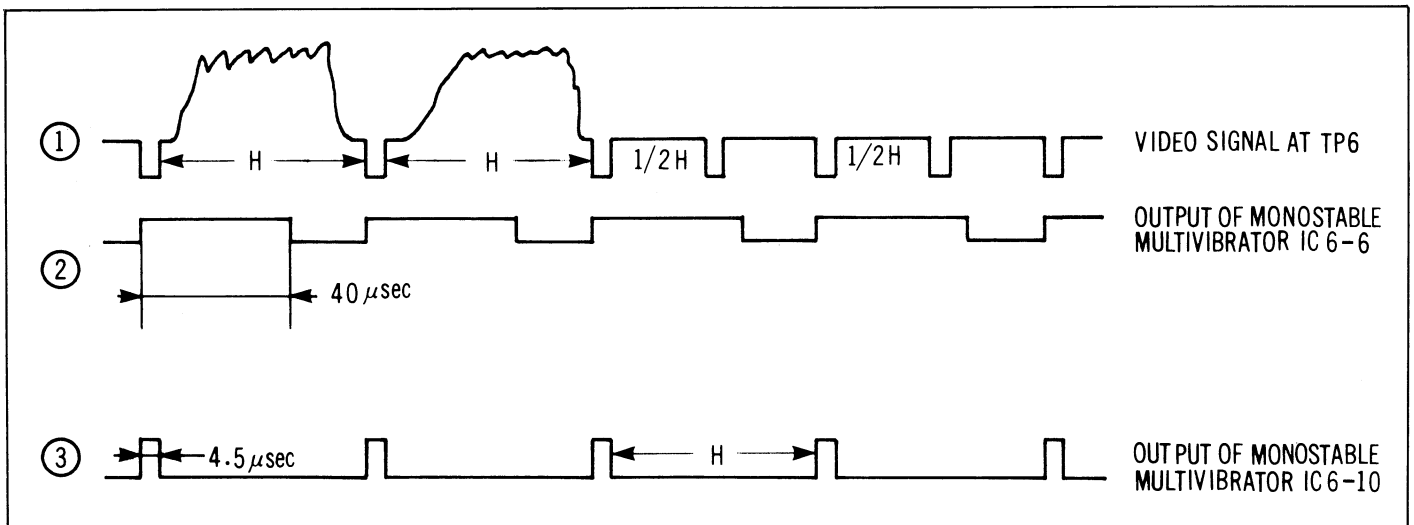


Figure 2-108

Color Playback Circuit (VEP0856)

General

The Chrominance signal from the Head Amplifier is the input for the chrominance playback circuit. Since the chrominance information was down-converted to a frequency band centered at 688 kHz, the chrominance information is extracted from the FM (luminance) signal by passing through a low pass filter (FL1) whose upper cut-off frequency is approximately 1 MHz. This chrominance only signal is then sent to an ACC (Automatic Chroma Gain Control) circuit within IC2. Its purpose is similar to the ACC circuit on the Record board, which is to control the gain so as to reestablish the chrominance signal to its proper level. This is accomplished by taking the signal after it is re-converted back to 3.58 MHz, and measuring the burst level. The gain of the incoming 688 kHz signal is then automatically controlled such that the burst level of the re-converted 3.58 MHz signal is proper.

Next the signal is re-converted back up to the frequency band centered at 3.58 MHz, so that it conforms to NTSC standards and a conventional monitor can utilize the chrominance information. This is the basic function of the chrominance playback section and the one which requires most of the circuitry. The frequency reconversion is accomplished by balanced modulating the incoming (688 kHz) signal with a generated 4.27 MHz sine wave signal. As in the case of the frequency conversion during record, the balanced modulator (within IC2) produces an output which contains both the sum and the difference of the two input frequencies. For a balanced modulator, the input frequencies themselves are completely suppressed. In this case the difference portion of the balanced modulator output (3.58 MHz) is desired, as opposed to the sum portion (4.96 MHz). The 3.58 MHz portion is extracted by sending the balanced modulator output through a 3.58 MHz band pass filter (FL2).

This is the basic system for re-conversion of the chrominance signal. (See Fig. 2-109)

Unfortunately the signal from the video heads during playback contains a certain amount of time-base instability or jitter, which renders the chrominance signal unacceptable because it would cause constant hue shifting in the monitor. This jitter is caused by a number of factors such as erratic movement of the video tape around the head cylinder and posts, and stretch and contraction of the video tape. Actually the frequency of the chrominance signal during playback is centered at $688 \text{ kHz} + \Delta f$, where Δf represents the jitter component. In order to eliminate this Δf component, the generator which produces the 4.27 MHz signal must detect the Δf component and generate not 4.27 MHz, but $4.27 \text{ MHz} + \Delta f$, where Δf also corresponds to the jitter from the playback signal.

If this is done, both inputs to the balanced modulator contain a Δf component and the result and signal used is the difference (3.58 MHz).

Notice that for the difference portion of the balanced modulator output the Δf component is cancelled out ($\Delta f = 0$), and therefore a chrominance signal centered at 3.58 MHz without any jitter factor is obtained. The cancellation of the jitter factor depends upon accurately making the $4.27 \text{ MHz} + \Delta f$ signal.

The playback process also causes some phase errors. These phase errors are cancelled in the same fashion by adding phase error to the $4.27 \text{ MHz} + \Delta f$, which will cancel is the balanced modulator.

After the chrominance signal is reconverted to 3.58 MHz without jitter and without phase error, the signal is then amplified by IC2. Next the signal is buffered by Q8, whose output is used to mix with the luminance signal.

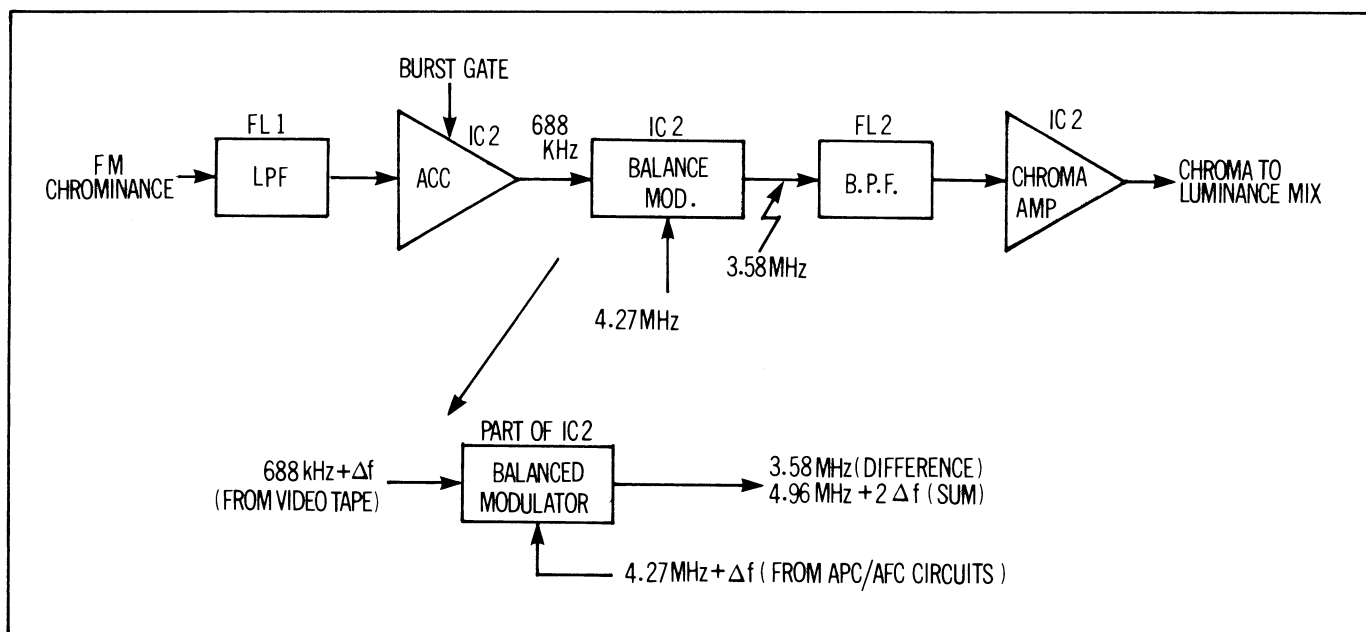


Figure 2-109

Detailed Description

Amp and Low Pass Filter

The FM-Chrominance signal from the head amp. circuit, P81-5 or the chrominance E-E signal, P81-1 is selected by the switches within IC1 (IC1-1, 2 and IC1-3, 4).

The output of these switches is amplified by Q1 and then sent through a low pass filter, FL1 which blocks all frequencies above 1.2 MHz, thus allowing only the down-converted chrominance (centered at 688 kHz) to pass. Q2 turns on during the time code signal period to shunt the

The chrominance signal is then sent to the phase compensator which consists of Q3, Q4, C7, R18, L1, C6 and R16. R16 is luminance/chrominance (Y.C.) Delay Adjustment which can be adjusted up to approximately 170 nsec. (See Fig. 2-111.)

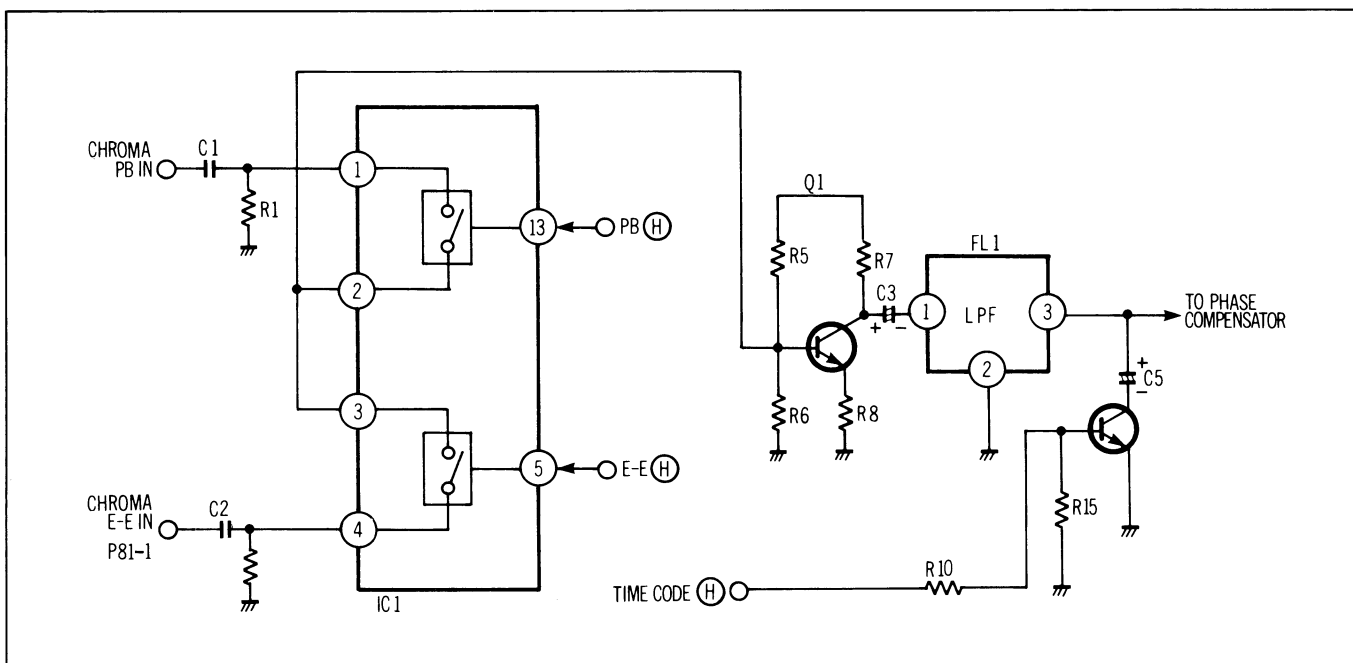


Figure 2-110

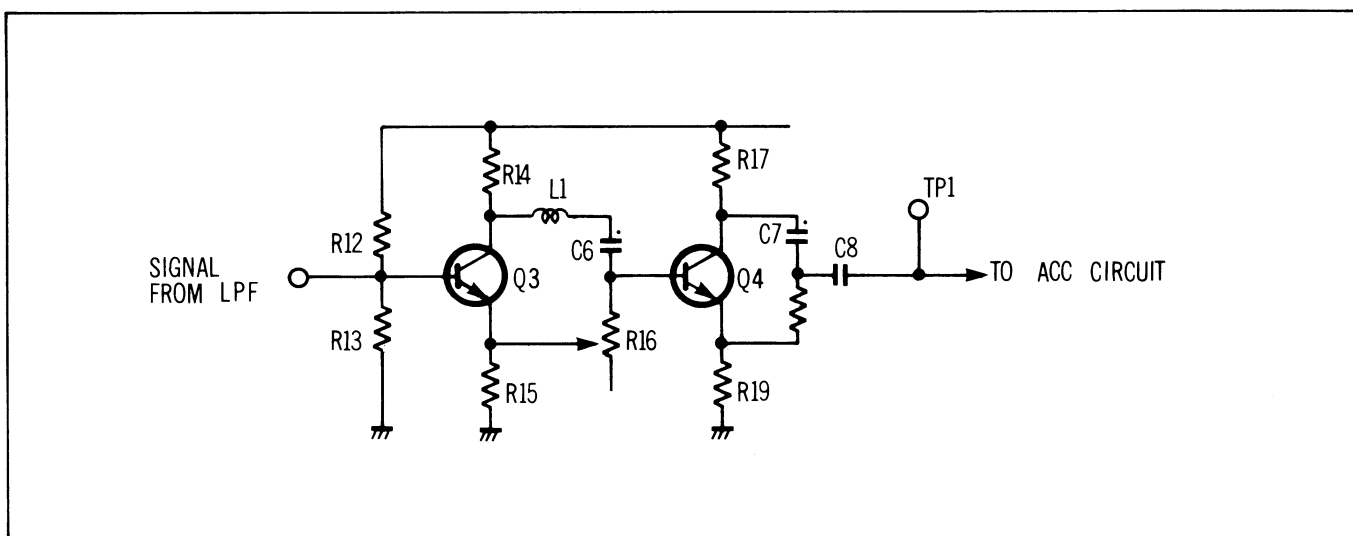


Figure 2-111

ACC (Automatic Chroma Gain Control)

As described in the general description, the ACC circuit controls the gain of the incoming 688 kHz Chrominance signal such that the burst level of the reconverted chrominance (3.58 MHz) is proper.

The 688 kHz Chrominance signal enters the ACC amp at pin 18 of IC2, and its gain is automatically controlled as follows. The Chrominance signal, after it has been converted back up to 3.58 MHz, is fed back to a burst gate at pin 6. In addition, a burst gate pulse generated from horizontal sync stripped from the video playback signal, also enters the burst gate at pin 4 allowing only the burst portion of the chrominance signal to pass the Burst Level Detector. The Burst Level Detector then converts the burst level of the chrominance signal to a DC voltage, held by C34-C37. This DC is then used to control the gain of the ACC amplifier.

If the burst level is too high then the gain is lowered, and if the burst level is too low, the gain is increased. In this way the burst level, and hence the chrominance gain, is automatically controlled to the proper level. (See Fig. 2-113)

Since each video head may have slightly different chroma response characteristics that may change with time, a separate set of chroma gain detect storage capacitors is used. This storage is required since the burst is sampled at the start of each line of video and this fixes chroma gain for the remainder of that line.

If the chroma response for each head were different, and a common capacitor used, it would be slow to respond and the chroma gain would vary at the head switching point. Two sets of capacitors, put in the circuit by the head switching signal, eliminate this problem. A resistor for slow discharge of the capacitors is needed during active picture, but at the interval just following head switching there is no burst to use for a reference, so the discharge resistor is removed by the blank pulse. (See Figure 2-112).

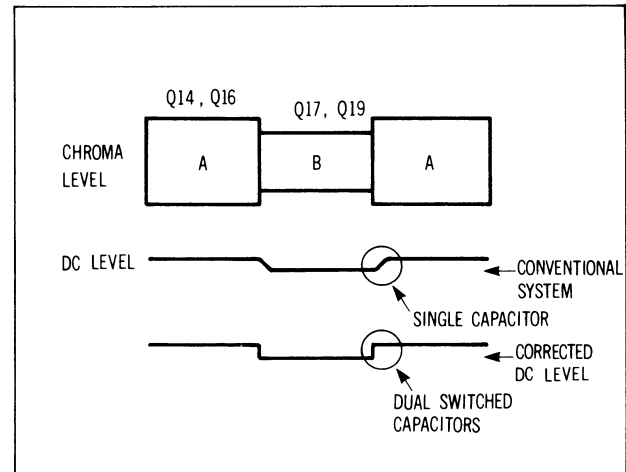


Figure 2-112

During playback, the detected burst passed by the burst gate circuit is detected and converted to a DC level, which is stored in C34, C35, C36 and C37. Q14 and Q16 turn on during A head period and Q17 and Q19 turn on during B head period as shown in Fig. 2-114. And R59 performs as the discharge except during the blanking pulse period. The object of this circuit is to minimize the color gain slew factor which occurs at the switching point, due to the unbalanced envelope of A and B heads.

During the dubbing mode, C35 and C37 are removed to improve ACC response time. DUB SELECT (H) from connector P83-(4) is supplied to the bases of Q15 and Q18 which turn on and Q16 and Q19 are inhibited.

During the E-E mode, a low level from P83-(5) is supplied to D4 to inhibit the headswitching signal and only C36 and C37 are active. See Figure 2-114.

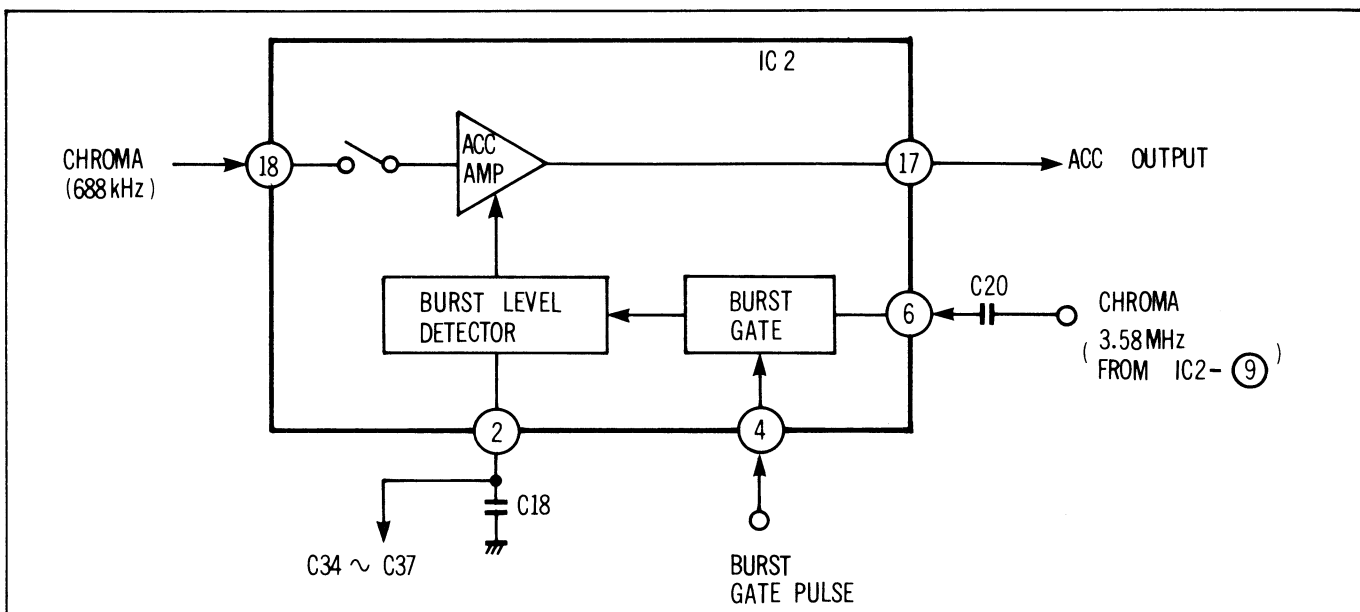


Figure 2-113

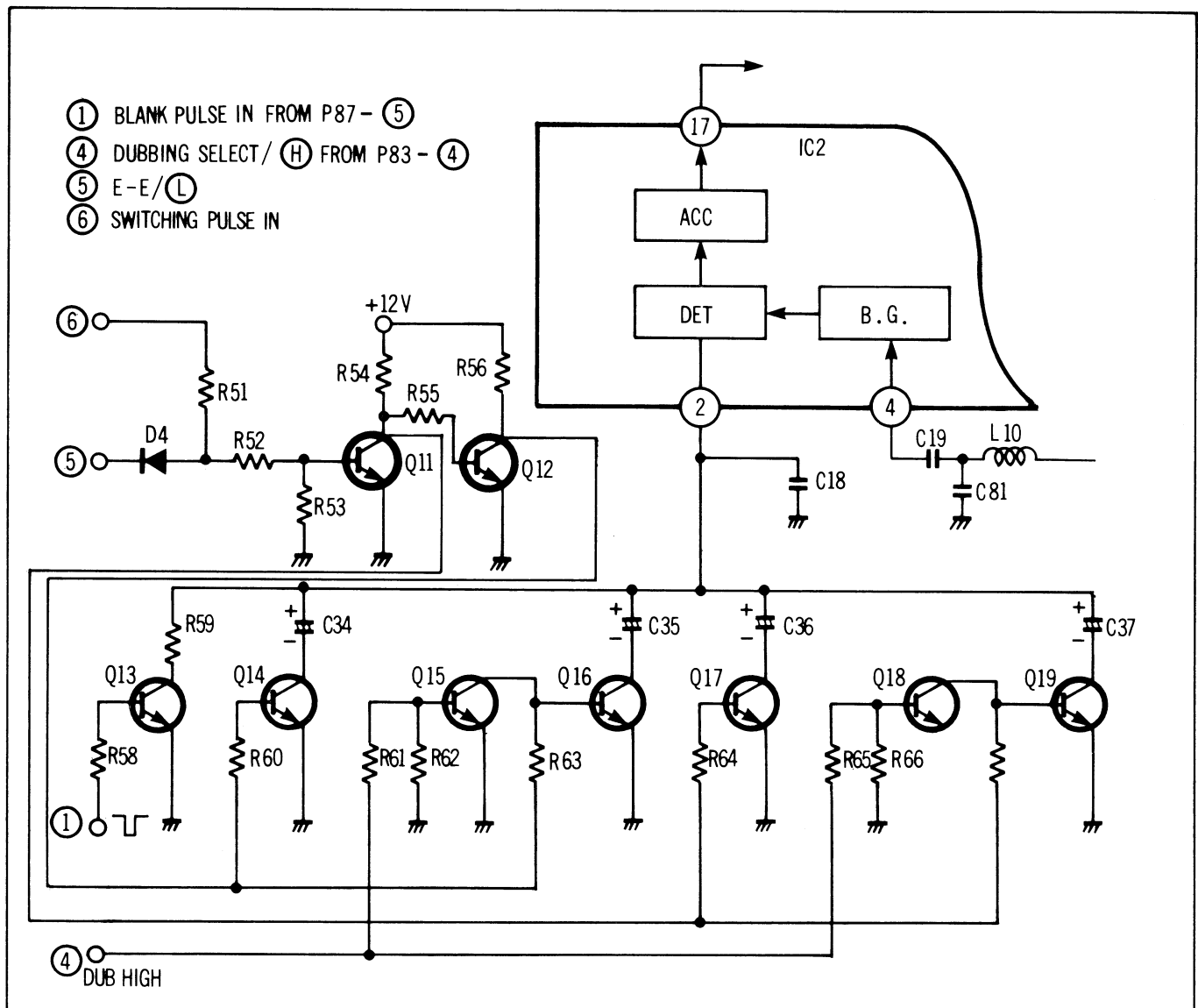


Figure 2-114

Burst Gate Pulse

The burst gate pulse used by the Burst Gate inside IC2 is derived from playback video horizontal sync slightly delayed to coincide with the burst region. This pulse comes from IC5-(3) through delay stage which consists of L10, and C81. H sync enters IC5 at pin (27).

CHROMINANCE FREQUENCY CONVERSION

(688 kHz to 3.58 MHz)

General

After the 688 kHz chrominance signal has been set to its proper level by the ACC circuit, it must be converted back to original 3.58 MHz region. This is accomplished by sending the signal as well as an internally generated 4.27 MHz + Δf signal to a balanced modulator which cancels the jitter component within the playback chrominance signal (688 kHz + Δf), and also converts the signal to 3.58 MHz.

(See Figure 2-115).

The most critical portion of the frequency conversion process is generating the 4.27 MHz + Δf signal. The accuracy with which the generated Δf portion follows the Δf portion of the incoming signal determines how completely the jitter factor can be removed.

The 4.27 MHz + Δf Generator is a closed loop system consisting of one fixed crystal controlled oscillator (serving as a phase reference), and two voltage controlled oscillators; one Automatic Frequency Control oscillator and one Automatic Phase Control oscillator.

Actually this system consists of one closed loop within another closed loop as shown in Figure 2-114.

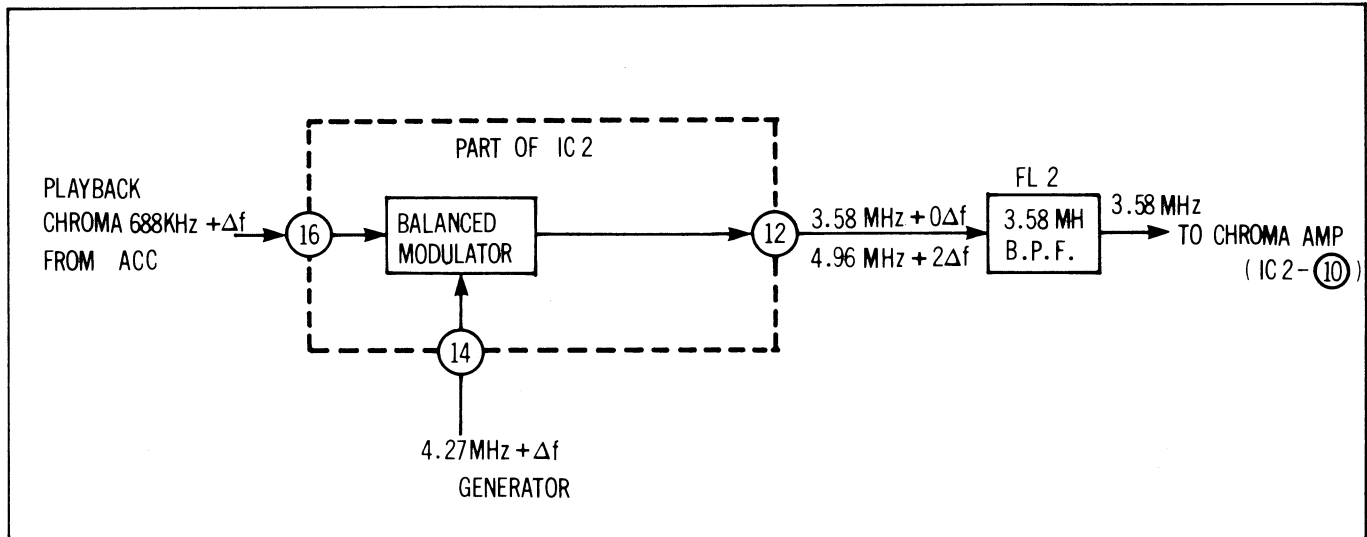


Figure 2-115

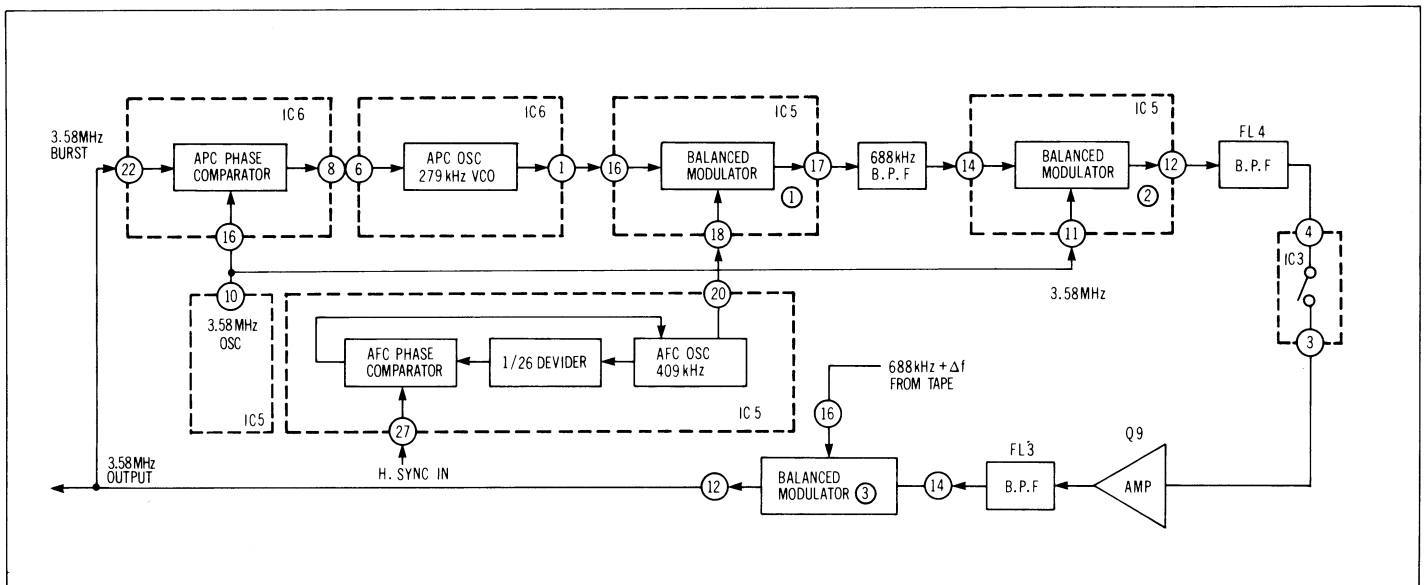


Figure 2-116

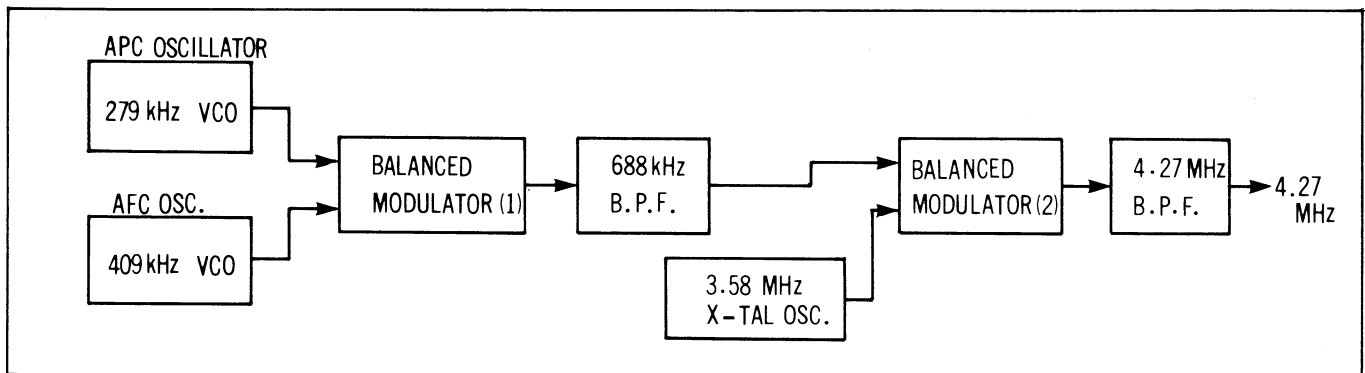


Figure 2-117

As shown in Fig. 2-117, the APC oscillator generates 279 kHz. The AFC oscillator when not being controlled generates 409 kHz. These signals are fed to the two inputs of Balanced Modulator (1), and the output is the sum and difference of the input frequencies. In this case the sum frequency is desired (688 kHz), which is extracted by a 688 kHz band pass filter.

This signal along with the signal from the 3.58 MHz crystal oscillator is sent to Balanced Modulator (2), and the sum frequency (4.27 MHz) is extracted by a 4.27 MHz band pass filter. Thus without any error control to the voltage controlled oscillators (AFC loop and APC loop open), a 4.27 MHz signal is generated. In order to generate $4.27 \text{ MHz} + \Delta f$, the frequencies produced by the two voltage controlled oscillators must change according to the Δf and phase of the incoming signal.

AFC Loop

The purpose of the AFC loop is to develop a signal whose frequency error is proportional to the horizontal sync frequency error of the playback video signal. The AFC phase comparator controls the AFC oscillator (with a DC control voltage) so that it produces a frequency 26 times the horizontal sync frequency at any instant. Thus if the frequency of the horizontal sync is slightly high, the AFC oscillator frequency will increase, and vice versa. See Figure 2-118.

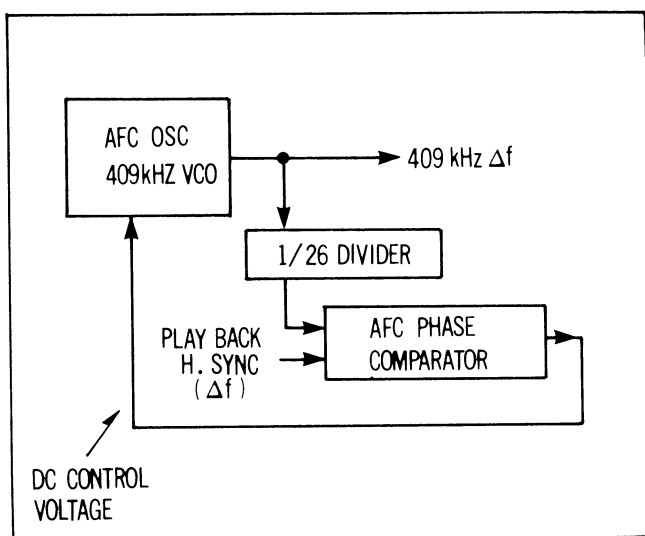


Figure 2-118

APC Loop

The APC loop encompasses the rest of the $4.27 \text{ MHz} + \Delta f$ Generator circuitry (refer to Fig. 2-116) and its purpose is to control the APC oscillator (279 kHz VCO) so that when its output frequency is added to the frequency of the AFC oscillator by Balanced Modulator (1), the sum equals $688 \text{ kHz} + \Delta f$, exactly the input frequency. With the APC and AFC loops open, a frequency of 688 kHz would be generated at the output of balanced modulator (1). The Δf portion is added once the loops are closed.

The AFC oscillator contributes approximately 60% of the Δf , the APC loop about 40%.

The APC loop works in the following fashion. The output of the APC and AFC oscillators are sent to Balanced Modulator (1). Assume that the sum frequency is close to $688 \text{ kHz} + \Delta f$. This signal and the 3.58 MHz reference signal are sent to Balanced Modulator (2), and the resulting frequency is approximately $4.27 \text{ MHz} + \Delta f$. This signal, in addition to being the output, is also fed back to Balanced Modulator (3).

The chrominance playback signal, which during the burst portion is exactly $688 \text{ kHz} + \Delta f$, is also fed to Balanced Modulator (3).

The difference frequency during the burst portion is approximately 3.58 MHz. The precision of this 3.58 MHz depends upon how accurately the Δf is generated in the $4.27 \text{ MHz} + \Delta f$ signal:

$$(4.27 \text{ MHz} + \Delta f) - (688 \text{ kHz} + \Delta f) = 3.58 \text{ MHz}$$

NOTE: These numbers have been rounded off, but the principle of cancelling the Δf is correct.

If the frequency during burst is exactly 3.58 MHz, then the Δf at that instant is exactly correct. To measure this frequency, the signal is sent through a burst gate, which allows only the burst portion of the signal to pass.

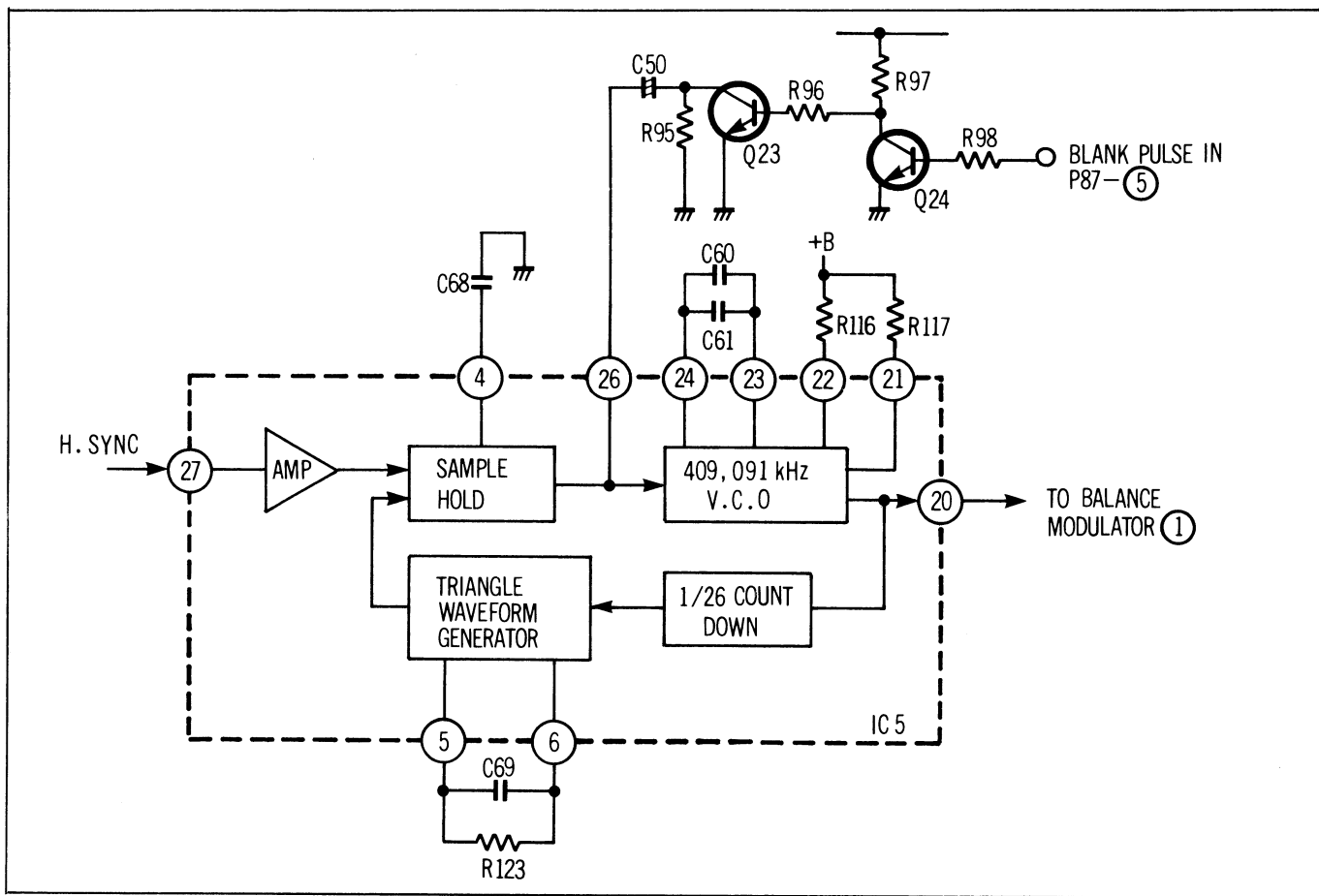


Figure 2-119

This burst only portion is compared against the 3.58 MHz crystal oscillator which serves as a reference. The comparison is made by the APC Phase Comparator, whose output is a DC voltage that controls the APC oscillator (279 kHz VCO). If the frequency and phase of the burst portion is exactly the same as the 3.58 MHz crystal oscillator frequency, then no change is made to the DC control voltage output of the APC Phase Comparator and the APC oscillator continues at the same frequency (4.27 MHz + Δf is correct).

If the 4.27 MHz + Δf frequency or phase was not exactly correct, then the burst input of the APC Phase Comparator would not match the reference. Therefore, a DC control voltage would change in the direction which corrects the APC oscillator. This correction in frequency travels back around the APC loop of the three balanced modulators, and the APC Phase Compensator continues to correct to APC oscillator frequency until the frequency and phase of the burst input is exactly the frequency of the 3.58 MHz crystal.

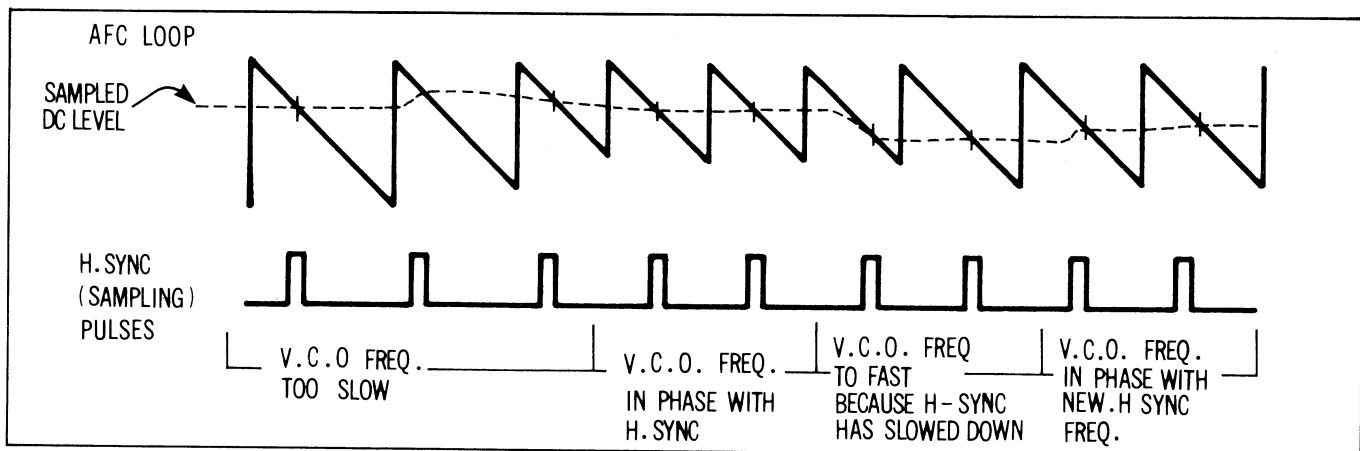


Figure 2-120

CHROMINANCE FREQUENCY CONVERSION

Detailed

The AFC is a phase lock loop that operates at 26 times the playback horizontal sync frequency. Therefore as the horizontal sync frequency shifts due to changes in head to tape speed, so does the output frequency of the AFC oscillator. This signal is sent to Balanced Modulator (1), to be combined with the APC output signal to create the desired $688 \text{ kHz} + \Delta f$.

In the AFC loop, IC5 contains a VCO whose free-run frequency is determined by R117, R116, C60, C61 at pins (21)-(24) and the voltage at pin (25) ($409.091 \text{ kHz} = 15.73426 \text{ kHz} \times 26$). This output signal is also fed to a 1/26 count down circuit within the IC (See Fig. 2-119).

The output of this count-down triggers a sawtooth generator whose slope is determined by C69 and R123. The sawtooth frequency is compared with the horizontal sync amplified from Pin 27 by sending both to a sample and hold circuit. The sample measures the DC level of the sawtooth during the presence of the horizontal sync (sampling) pulse, and stores that DC level at C68. This DC level, which is further filtered by C50/R95, is the control signal for the VCR, increasing or decreasing its frequency so that the sync pulse always samples the center of the waveform. The frequency of the voltage controlled oscillator is thereby made exactly 26 times the horizontal sync frequency (See Fig. 2-120).

BALANCED MODULATOR (1)

As previously described, the output of the 409 kHz AFC oscillator (IC5-20) along with the output of the 279 kHz APC oscillator (IC6-1) is sent to the two inputs of Balanced Modulator (1) (IC5-18,16).

A typical balanced modulator is shown in Figure 2-121.

The inputs to the balanced modulator are V1 and V2, and the output is V0. A balanced modulator is actually a multiplying device whose output can be calculated as follows:

$$V0 = K (V1 \times V2)$$

Where K is a constant factor for the particular balanced modulator. In the case of Balanced Modulator (1)

$$V1 = E \text{ AFC } \cos \omega_{\text{AFC}} t$$

(ω_{AFC} is proportional to AFC frequency)

$$V2 = E \text{ APC } \cos \omega_{\text{APC}} t$$

(ω_{APC} is proportional to APC frequency)

$$V0 = K [E \text{ AFC } \cos \omega_{\text{AFC}} t \times E \text{ APC } \cos \omega_{\text{APC}} t]$$

$$Q [\cos (\omega_{\text{AFC}} + \omega_{\text{APC}}) t + \cos (\omega_{\text{AFC}} - \omega_{\text{APC}}) t]$$

where Q is another constant to simplify the equation.

Notice that by multiplying the two input signals, neither of the two input frequencies appear at the output. Only the sum of the input frequencies ($\omega_{\text{AFC}} + \omega_{\text{APC}}$), and the difference of the input frequencies ($\omega_{\text{AFC}} - \omega_{\text{APC}}$) appear at the output. The sum of the input frequencies is $688 \text{ kHz} + \Delta f$, which is the desired portion. It is extracted by sending the output of the balanced modulator through a 688 kHz band pass filter consisting of L16, L17 and C77.

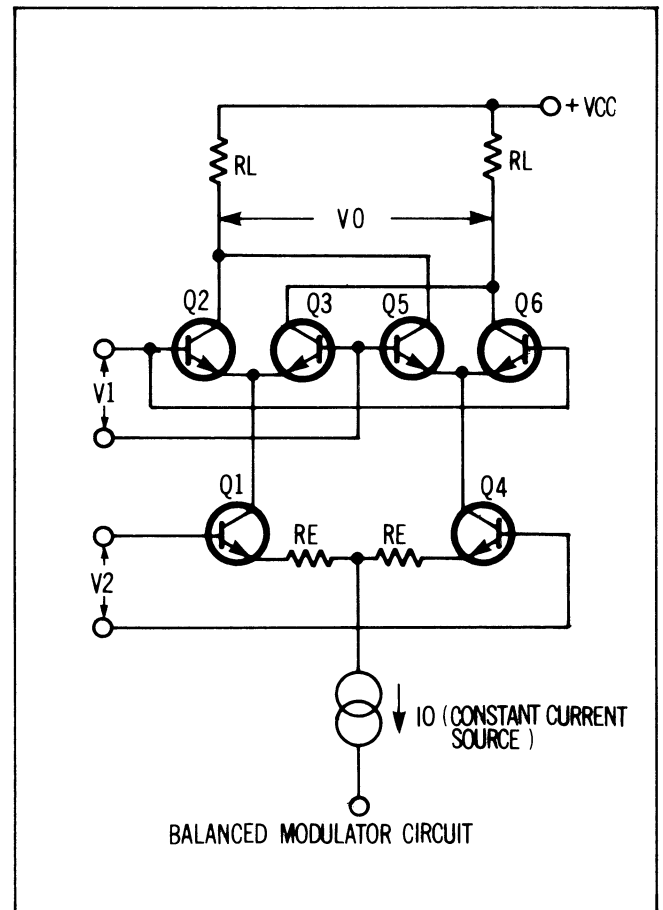


Figure 2-121

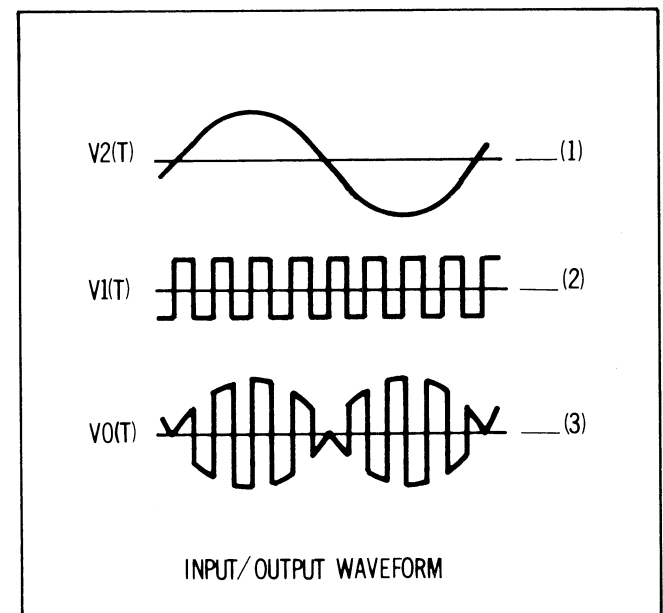


Figure 2-122

APC Phase Comparator

The 3.58 MHz signal from the crystal oscillator (IC5-10) is sent to one input of the AFC phase comparator, and 3.58 MHz burst from the output signal, extracted by the burst gate in IC2 (pin 3) and passed by another burst gate (IC6-27-23), are compared of IC6, pins 22 and 16. R133 sets the burst gain to match the 3.58 reference. At IC6 pin 8 a D.C. voltage proportional to the phase error appears. This is filtered by R137, R138, R139, C93, C94 and C95.

3.58 MHz Crystal Oscillator

The internally generated 3.5 MHz signal is made by a crystal controlled oscillator within IC5.

C71 allows frequency adjustment of the oscillator and should be adjusted for $3.579545 \text{ MHz} \pm 5 \text{ Hz}$ (See Fig. 2-123).

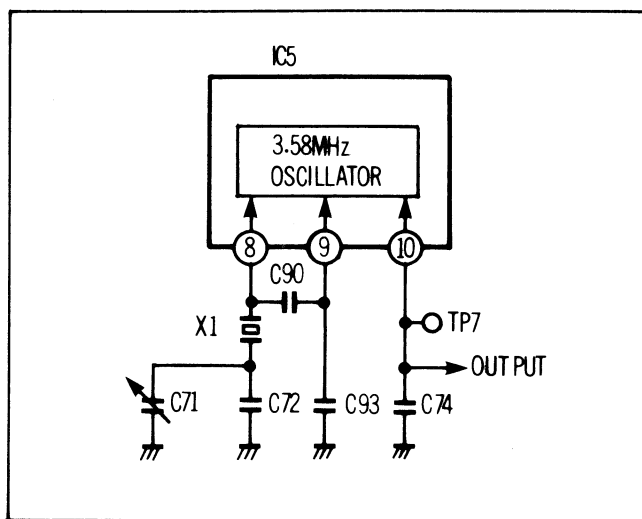


Figure 2-123

APC Voltage Controlled Oscillator

The filtered DC control voltage applied to the 279 kHz VCO (IC6-6) to control the instantaneous frequency. The center range or free run fo the APC oscillator is set by R130, and the rear panel control R6311, as a D.C. voltage at IC6 pin 7.

The basic frequency is set by R134, R135 and C91, C92. A band pass filter made up of C90 and L13 blocks extraneous signals from the 279 kHz $\pm \Delta f$ signal which is supplied to Balanced Modulator (1) at IC5 pin 16. The other input to Balanced Modulator (1) is 409 kHz $\pm \Delta f$ from the AFC loop. The resulting 688 kHz $\pm \Delta f$ is mixed (balance modulated) with the same 3.58 crystal signal to produce the final 4.27 MHz $\pm \Delta f$ signal.

The APC loop is closed because this final 4.27 MHz $\pm \Delta f$ goes to Balance Modulator (3), to mix with the 688 playback information. The APC/AFC process then starts again, as any fluctuations in the playback (incoming) 688 kHz signal are detected and used to make the 4.27 MHz signal fluctuate by the exact same amount. Since the difference between the 4.27 MHz $\pm \Delta f$ signal and the playback is used in Balanced Modulator (3), a stable 3.58 MHz color signal output.

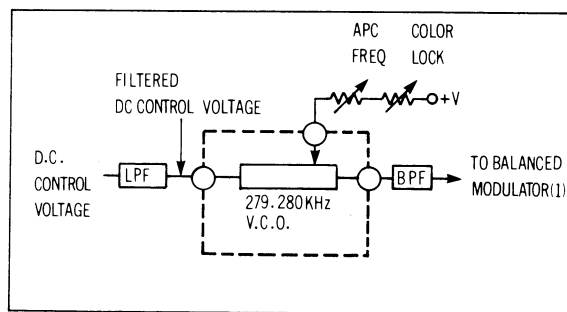


Figure 2-124

Blank Pulse

The head switch occurs during the vertical blanking interval, and presents two problems for chroma playback.

The head switching point represents the maximum Horizontal Sync error, and no burst (chroma information) is present in the signal until about 8 H lines after head switching. Because of this, the ACC, the APC and AFC tend to make false corrections. The blank pulse follows every headswitching transition, and is used to overcome these problems.

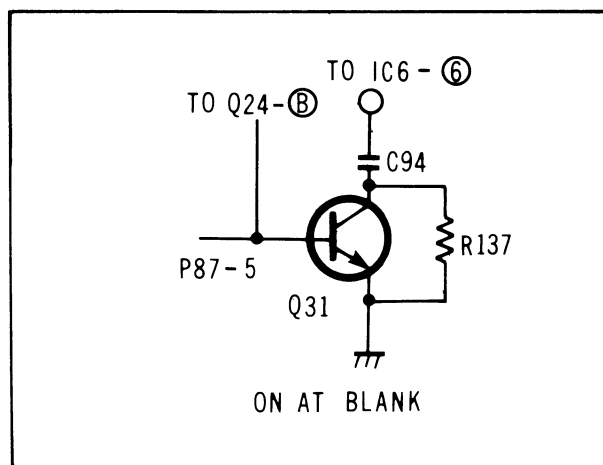


Figure 2-126

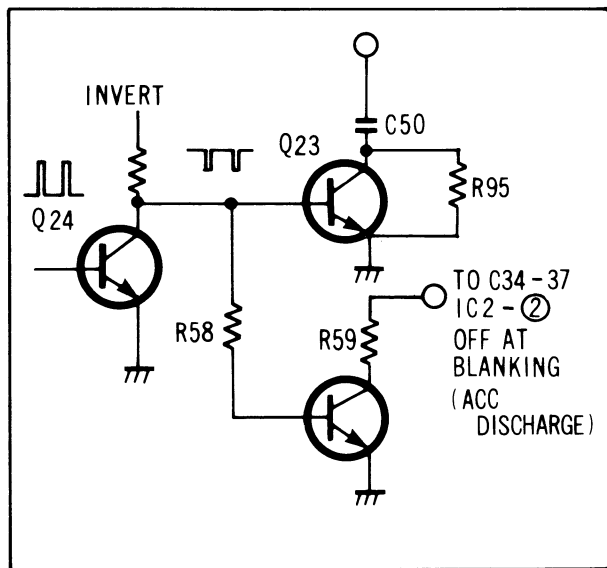


Figure 2-127

In the APC loop, C94 and R147 normally function as a series filter. During the blank pulse, when no burst is present (APC loop cannot function), Q31 is ON to remove R137 and the lower filter impedance holds the 279 kHz VCO. (See Figure 2-126)

In the AFC loop C50 filters the H error voltage. At the headswitching point, where there is the greatest H error, R95 is added in series with C50 by Q23. After headswitching, the inverted blank pulse removes R95. (See Fig. 2-127 and 119)

In the ACC circuit the blank pulse inverted by Q24 removes the discharge resistor R59, since there is no burst directly after head switching and a gain loop adjustment can not be made. This allows the previous charge to remain in C34-37. (See Fig. 2-114)

If a timebase corrector (TBC) is used, one stage of heterodyne processing within the TBC can generally be saved, and signal to noise performance improved, if a 3.58 Δf MHz is fed back to the APC/AFC loop to defeat the loop and to allow the TBC to control subcarrier (chroma) correction of the mixed (composite) output of the VCR. Therefore, an external 3.58 MHz input is provided.

If an external 3.58 MHz signal is supplied to the subcarrier connector, it appears at P82-5. This signal is fed to the base of Q21, amplified, and rectified by D16. This High signal is supplied to the base of Q22 (Ext. 3.58 MHz Detector), Q22 turns on and the switch IC4 (3, 4), turns off. Therefore, 3.58 MHz crystal oscillator signal is not supplied to pin (11) of IC5 (Balanced Modulator).

Normally, IC4-(3, 4), (External 3.58 MHz) is off and IC4 (1, 2) is on the 3.58 MHz signal from the IC5-10 oscillator goes to pin 11 of IC5 (Balanced Modulator). D13, D14 and Q20 form a limiter for either 3.58 MHz signal. (See Fig. 2-128)

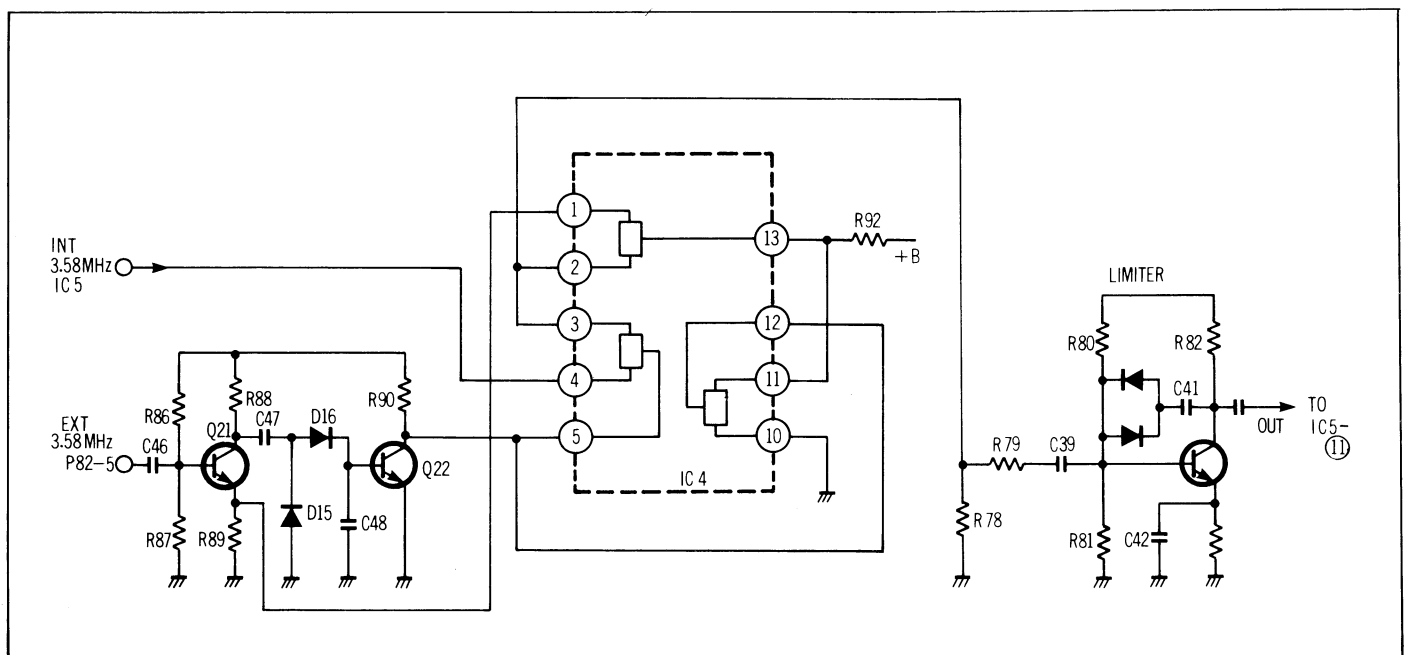


Figure 2-128

Dubbing Output

In the dubbing mode, this unit provides ACC processed 688 kHz playback Chroma for use by the recording machine as its input to enhance the chroma S/N of the dub. Dubbing chroma signal from ACC output, IC2-(17), is amplified by Q5 after the Dubbing chroma level control, R29. Then the 688 kHz chroma signal passes through 3.58 MHz trap, L14 and C23, to prevent cross talk, and to the delay circuit, DL1, whose purpose is to match the phase between chroma and luminance signal. Finally, the delayed chroma signal is buffered by Q7 and goes out to connector P86-(1). If the Playback signal is B/W, Q6 turns on to block all signal at the chroma output, including the D.C. bias which is used by the recording unit for color/BW switching in the dub mode. (See Fig. 2-129 and 130.)

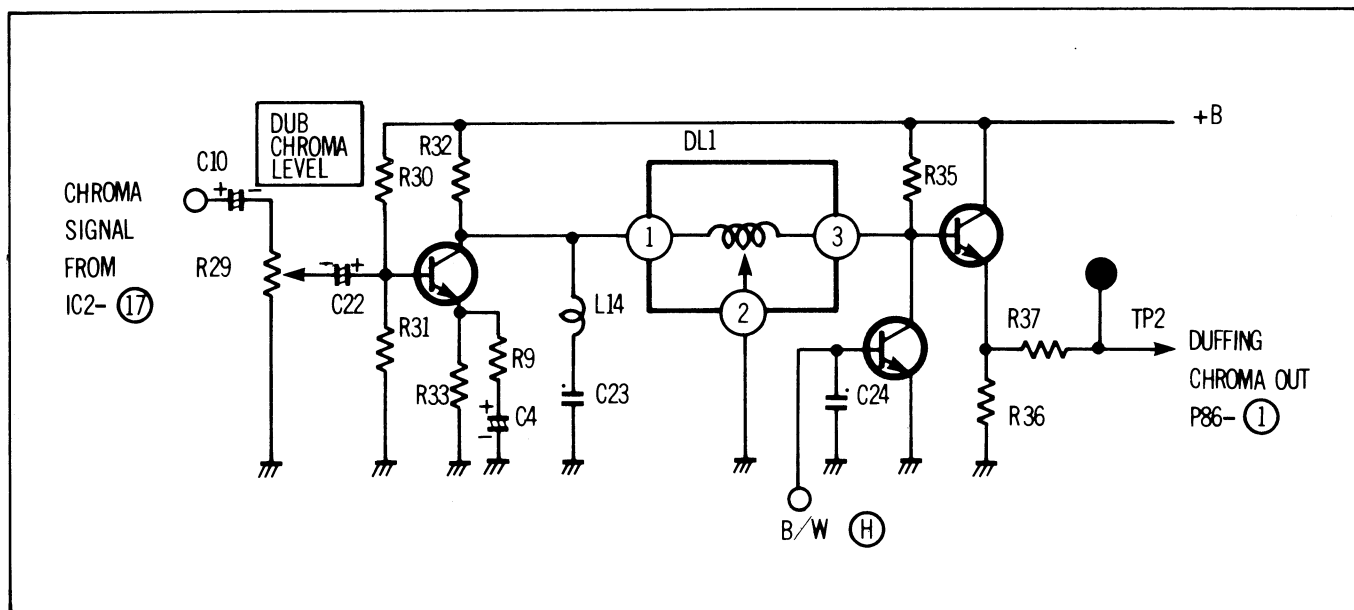


Figure 2-129

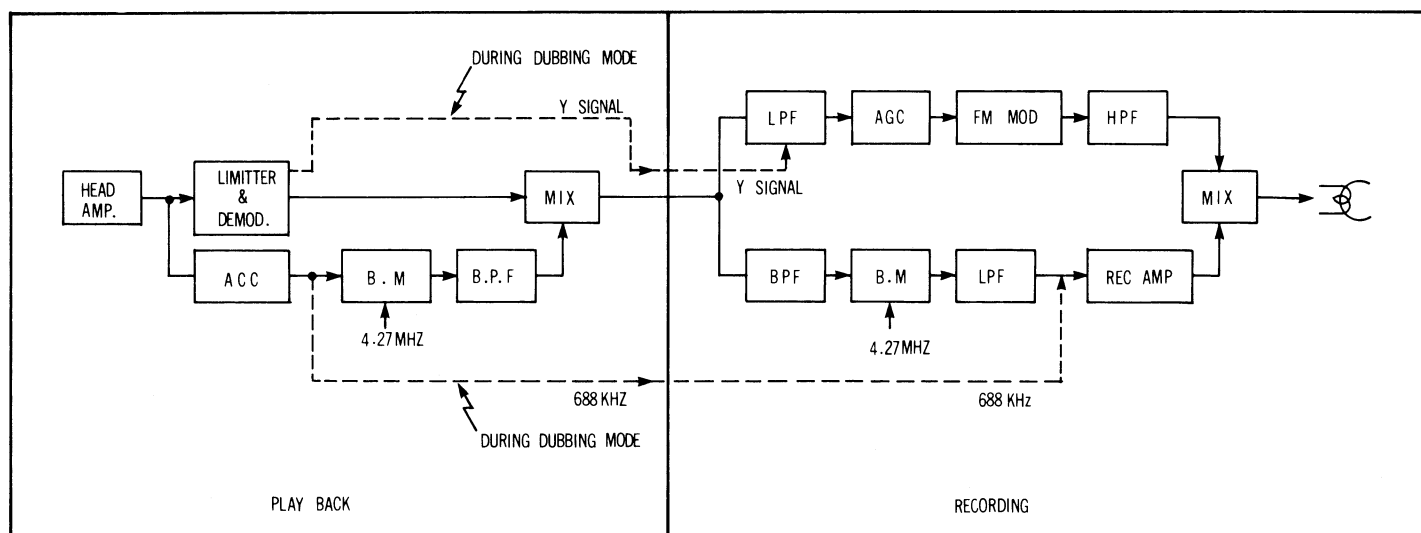


Figure 2-130

Servo Control Circuit

The Servo Control Circuit presents several new servo system concepts. The direct drive capstan allows for faster lock-up time for the capstan servo, better time-base stability, less wow, X5 speed playback, and a simplified transport mechanism. Since the NV-9600 offers five discrete speeds in two directions, suitable speed selection circuitry is required, not only for the capstan but for the cylinder as well.

Since a playback picture must be possible in all speeds, and since writing speed (tape to head speed) shifts as tape speed changes, the head cylinder speed must be changed to produce a video horizontal rate at near 15,734 Hz and color at 3.58 MHz. Additionally, playback at the head-switching point has been stabilized by new playback circuitry as well as better servo control.

The servo control circuit consists of two sections, the Cylinder servo section and the Capstan servo section.

Cylinder

The purpose of the Cylinder or Drum servo is to control the speed and the position (phase) of the video heads during the recording and playback process. During the recording mode, the video heads are positioned according to the timing of the vertical sync pulses of the incoming video signal. Refer to Figure 2-101, page 1-96, and note that the vertical interval is located at a specific point on the tape in each head pass.

During the playback mode, the video heads are positioned according either to the video input vertical sync signal, an external sync signal supplied from the rear panel or the internal sync signal supplied from the (1/59712) count down circuit, as selected by the Sync Selector Switch. A multipole brushless DC motor is attached directly to the shaft of the head cylinder. The drum section of the servo circuit (VEP02100) develops two DC voltages which control the Motor Drive Circuit (VEP0299), which in turn drives the cylinder motor. The cylinder servo system gets feedback information from two sources. One is from a frequency generator (F.G.), mounted on the motor shaft. The other is from the pulse generator (P.G.) or Detect coils mounted underneath the video head drum.

The cylinder servo actually therefore consists of two servos; a speed servo, for which the frequency signal is utilized, and a phase (position) servo, for which the pulse generator coils are used.

Capstan

The purpose of the capstan servo control system is to control the rotational speed and phase of the capstan shaft during the recording and playback modes. The capstan servo is also controlled by reference to the signal selected by the Sync Selector, the same signal used by the cylinder servo control system. The capstan is a DC direct drive multipole motor, which also has a frequency generator for capstan speed feedback.

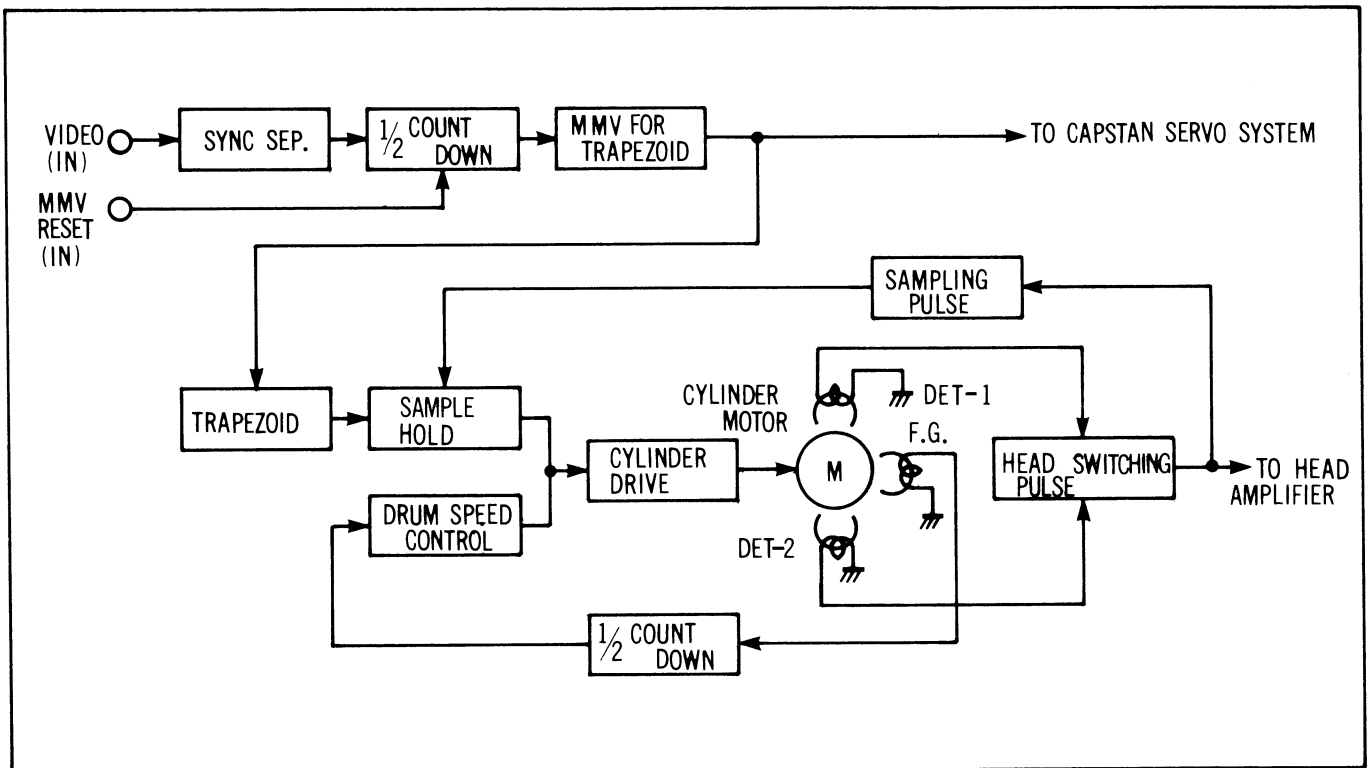


Figure 2-131

1. CYLINDER SERVO CONTROL CIRCUIT

1) GENERAL

A. Phase Servo-Recording Mode

During the recording mode, the reference for the phase servo is the vertical sync taken from the incoming video signal. The comparison signal is derived from the pulse generator (P.G.) coils, which reflect the instantaneous position of the video heads. Video signal appears at terminal (2) of P240 and is supplied to Pin (16) of IC12 to extract only the sync portion. A low pass integrator then allows only the 60 Hz vertical sync to pass. The frequency of this signal is then masked down by a monostable multivibrator within IC12 to become a 30 Hz signal. This 30 Hz signal is made into a 50% duty cycle square wave by another monostable multivibrator within IC12 (Pins (5) and (8)), and then converted into a trapezoidal wave form by a trapezoidal waveform generator within IC16 (Pins (15) and (17)). The signal from one P.G. (DET-1) coil is made into a sampling pulse by passing it through two monostable multivibrators within IC22 on the Sub-servo Circuit board (VEP00598). The trapezoid and the sampling pulse are sent to a gate, where the pulse transfers the coincident value of the trapezoid.

The output of the sample and hold stage is a DC level equivalent to the instantaneous level of the trapezoidal waveform at the time of sampling pulse. This DC level, which represents the phase relationship between the head position and vertical sync, appears at Pin (12) of IC16, and is the Phase Servo Control signal.

See Fig. 2-132.

B. Phase Servo-Playback Mode.

During the playback mode, the sync signal separated from the incoming video signal, the external sync signal supplied from the terminal (2) of connector P235 or the internal sync signal supplied from the 3.58 MHz (1/59712) count down circuit is used as the reference signal. The rest of the phase servo control functions in a manner identical to the record mode.

Head Switching Circuit

The 30 Hz PG pulses (DET 1) and (DET 2), supplied from the DET coils which are positioned under the head drum, are fed to terminals 1 and 2 of connector P241.

They are amplified at IC22 (15) and (16) on the sub servo circuit board (VEP00598) and then are supplied to F-F and Delay circuits within IC22. The output of the delay circuits toggle another Flip-Flop inside IC22. The head switching signal appears at pin (12) of IC22. The block diagram is shown in Fig. 2-133.

The position of each DET coil is electrically set by R205 (DET 2) and R217 (DET 1). The switching pulse is routed from pin (12) of IC22 to terminal (4) of connector P242 through Q53 on the sub servo circuit board.

The switching position is set to be 2.25 H before the start of vertical sync by R207 (Rec Shift).

The Head Switch signal is then used in the Head Amplifier circuit (VEP0539) for head switching, and within the servo. The output of the record shift MMV sets the sample pulse location. See Fig. 2-135.

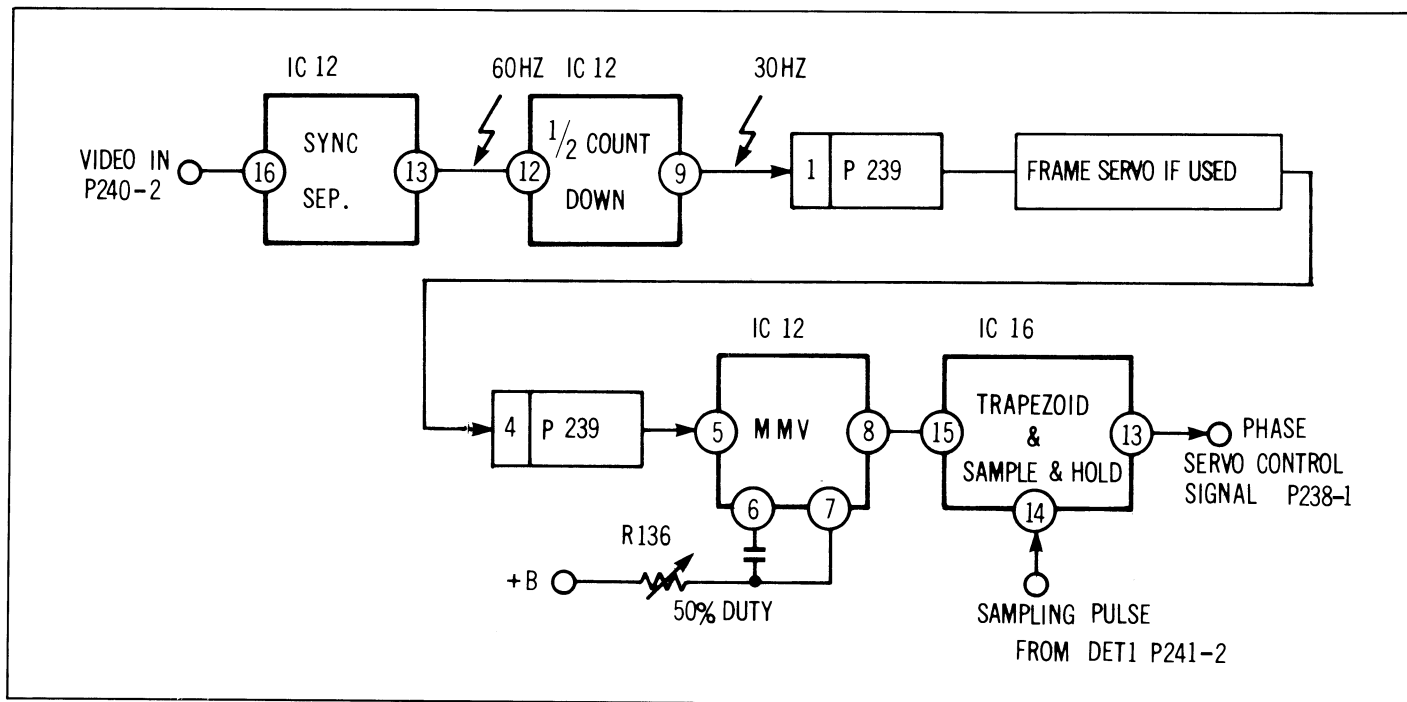


Figure 2-132

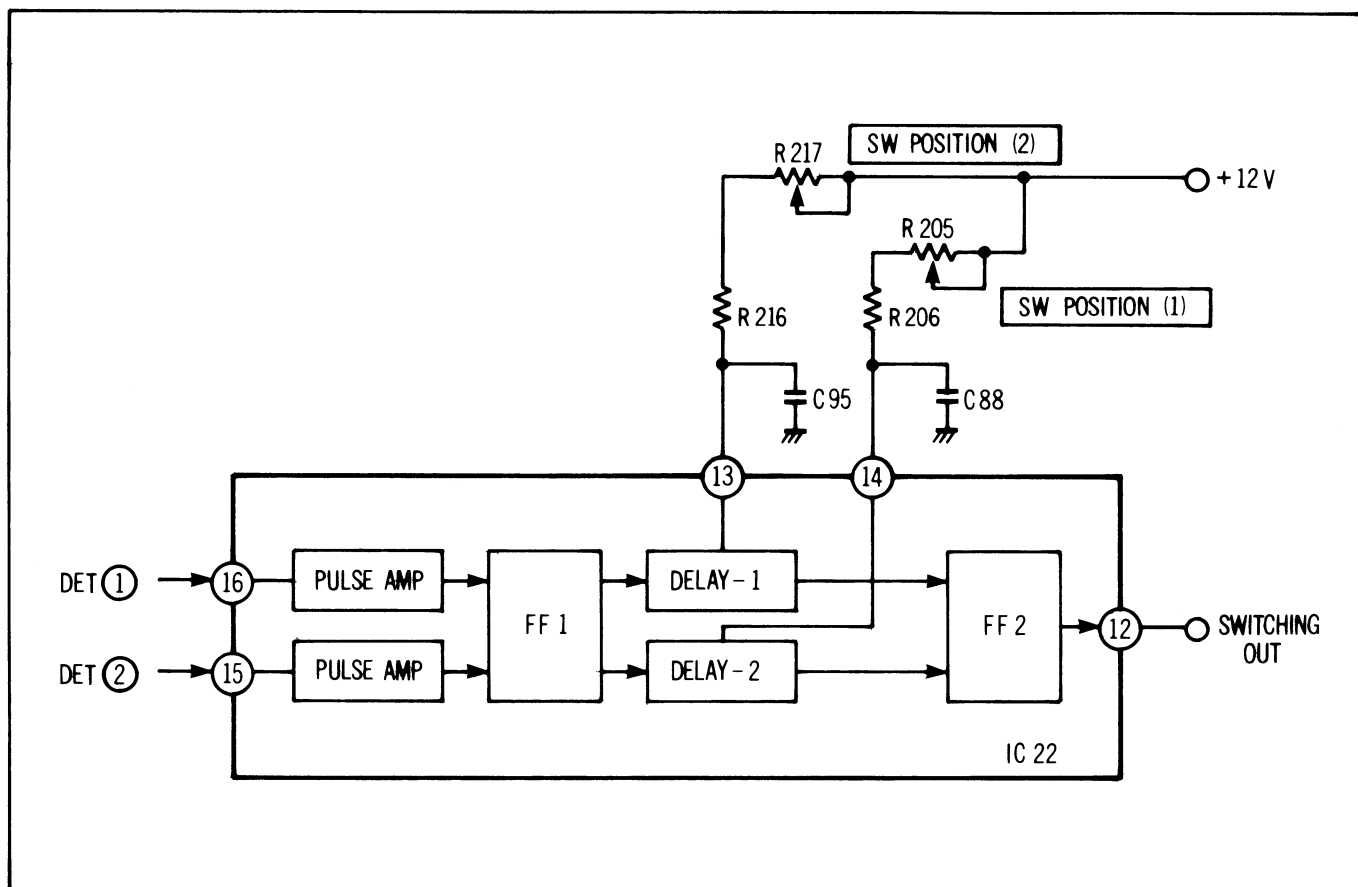


Figure 2-133

C. Speed Servo-Recording/Playback Mode

During all modes of recording and playing back, the Speed Servo control functions to establish the correct cylinder speed so that the Phase Servo control can establish the exact position of the video heads. The frequency generator (F.G.) signal is applied to Pin (4) of IC16 where it is counted down by 2. Then the 1/2 F.G. signal is applied to a MMV and gate circuit, where it is converted into pulses whose width varies inversely with the frequency (Speed).

The pulses are shaped into a trapezoid, and supplied to a sample and hold stage which gives the loop sufficient gain. The samples are then supplied to an integrator (C112) and amplifier (IC18), which serve as a motor speed detector. The output of this motor speed detector is the Speed Servo Control signal.

This signal controls the cylinder motor speed through the cylinder motor drive circuit. See Fig. 2-134.

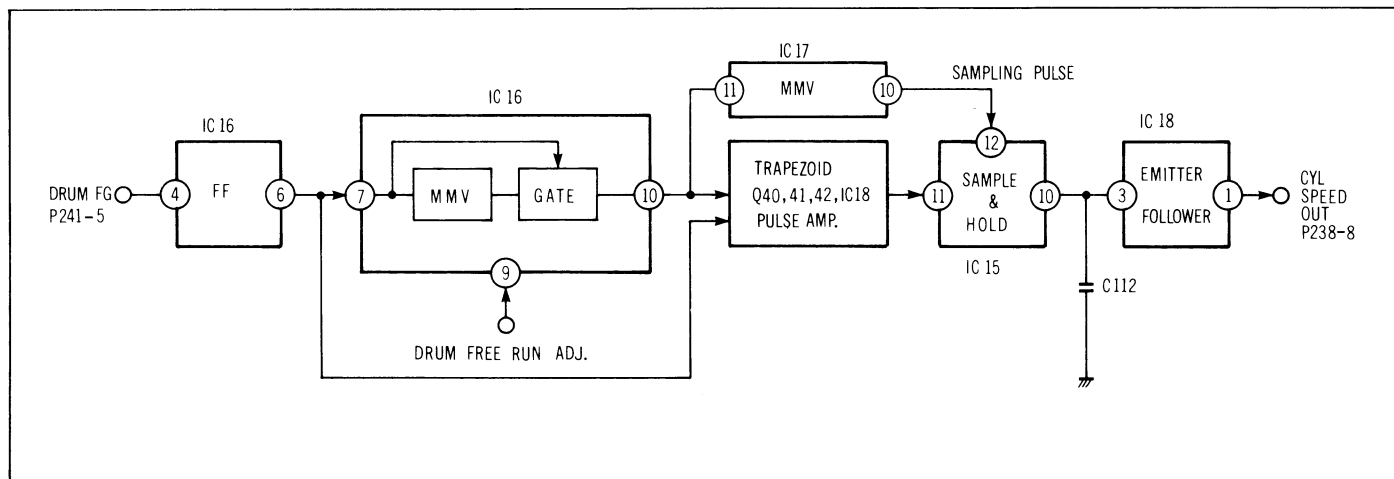


Figure 2-134

2) Detailed Circuit Description

A. Phase Servo Control: Record/Play

The input video signal which appears at Pin (2) of connector P240 is supplied to Pin (16) of IC12 (AN301). The video signal is amplified between Pins (16) and (15) and goes through the sync separator between Pins (14) and (13) of IC12. The composite sync signal is applied to the vertical sync integrator formed by R139-R141 and C50-C52. The separated vertical sync triggers a monostable multivibrator (MMV) IC12 (-12) whose duration is 23 ± 5 msec. through Q16, differentiator C56 and the inverter Q15. Since this duration is longer than 16.6 msec, every other vertical sync pulse is eliminated and the output rate of the monostable multivibrator is 30 Hz. The output signal at Pin (9) is sent to Pin (5) of IC12 through P239-(1), P103-(1), P101-(3) and P239-(4). This routes the signal to the Frame Servo board (VEP00510), where the signal is delayed 140 μ sec for H Servo control in the NV-9600. (The NV-9240 uses the same signal as the signal at P239-(1)).

In either case, the returned signal is at the 30 Hz rate. The monostable multivibrator IC12 (5-8) produces a 50% duty cycle square wave, set by R136.

The 50% duty cycle IC12 (8) output is applied to IC16 Pin 15, where the square wave is changed to a trapezoidal waveform to become the reference signal.

To obtain the sampling pulse, the 30 Hz head switching signal is used. On the sub servo circuit (VEP00598), the 30 Hz signal at Pin (12) of IC22 is inverted by Q52, and then differentiated by C122 and supplied to Pin (1) of IC22.

This amplified pulse triggers an MMV inside IC22 (See Fig. 2-136).

This MMV delay is set by R207, Record Shift, which serves to locate the sample time in correct relationship with the ramp of the trapezoid formed above. When the time of this MMV has elapsed, it triggers the sample MMV on the main servo board.

This Rec Shifter signal is supplied to an MMV (IC17) to obtain the sampling pulse width (6 μ sec) more accurately than an RC differentiator would.

The inverted pulse, taken from Q34, is used as the sampling pulse, at IC16 (14). The output of Q33, which is the same as the sampling pulse, is sent to the trapezoid generator circuit within IC16, in order to create a step in the trapezoid at the sample point. The sample and hold circuit detects the level of the trapezoid coincident with the occurrence of the sampling pulse, and stores that voltage.

IC15 (8), (9) is a switch which can disable the phase or position output, as described below, and Q43 and zener diode D69 set limits for maximum phase error voltage. It can not go above the zener point of D69 or fall below the conduction point of Q43 as set by R360, R361. This enhances lock up time.

This error voltage goes out terminal (1) of connector P238 as Servo Phase Out.

The IC15 switch, driven by Q51, the inverter, is opened during FWD X5, REV X5 and REV X2, and closed for all other modes.

This means that the cylinder servo for the X5 and Rev X2 modes is only controlled by the speed control as shown in Fig. 5 and Fig. 2-134 and 137.

IC19 and IC20 are NAND and AND gate circuits which produce REV X5 (H), FWD X5 (H) and REV X2 (H).

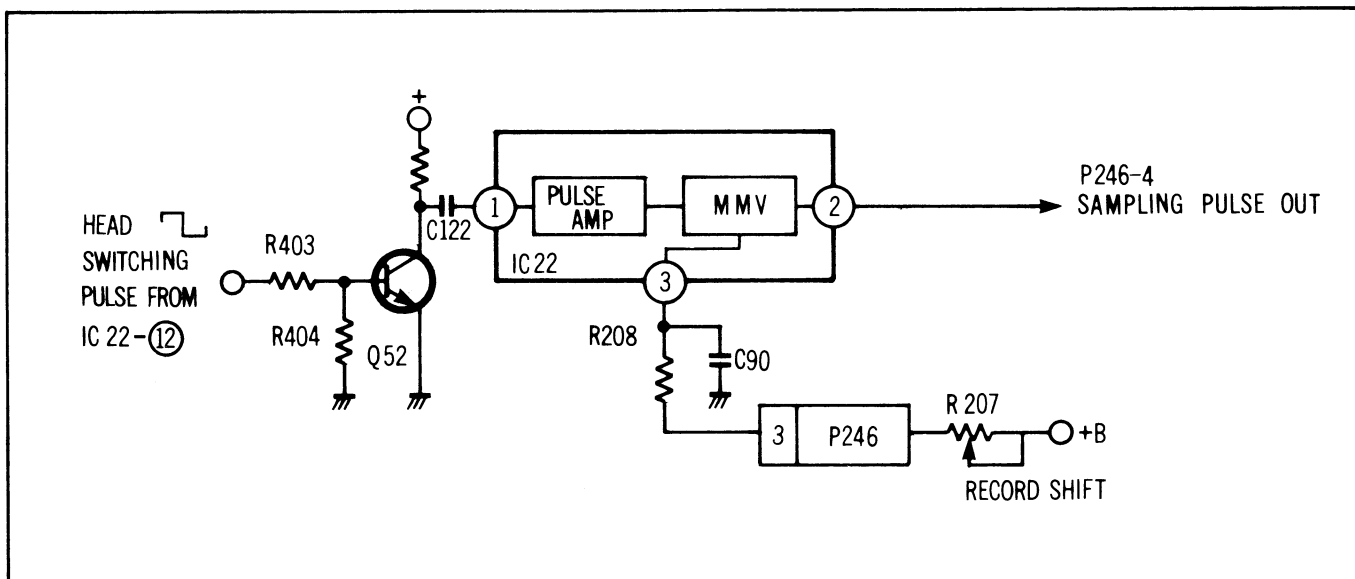


Figure 2-135

B. Speed Servo Control: Record/Play

The F.G. signal, a 2,100 Hz sine wave, is amplified by Q1 and Q2 on the Capstan/Cylinder Drive board (VEP0299) and comes to P241 Pin 4.

It enters IC16 at Pin (4) where a flip flop divides the frequency by 2. The 1,050 Hz square wave at Pin (6) of IC16

is fed into Pin (7) as the input to both a monostable multi-vibrator and an AND gate through an inverter. The other input to the AND gate is the output of the monostable multi-vibrator. The AND gate then produces a pulse whose width is equal to the difference in duration of its two input pulses (See Fig. 2-138 and 2-140).

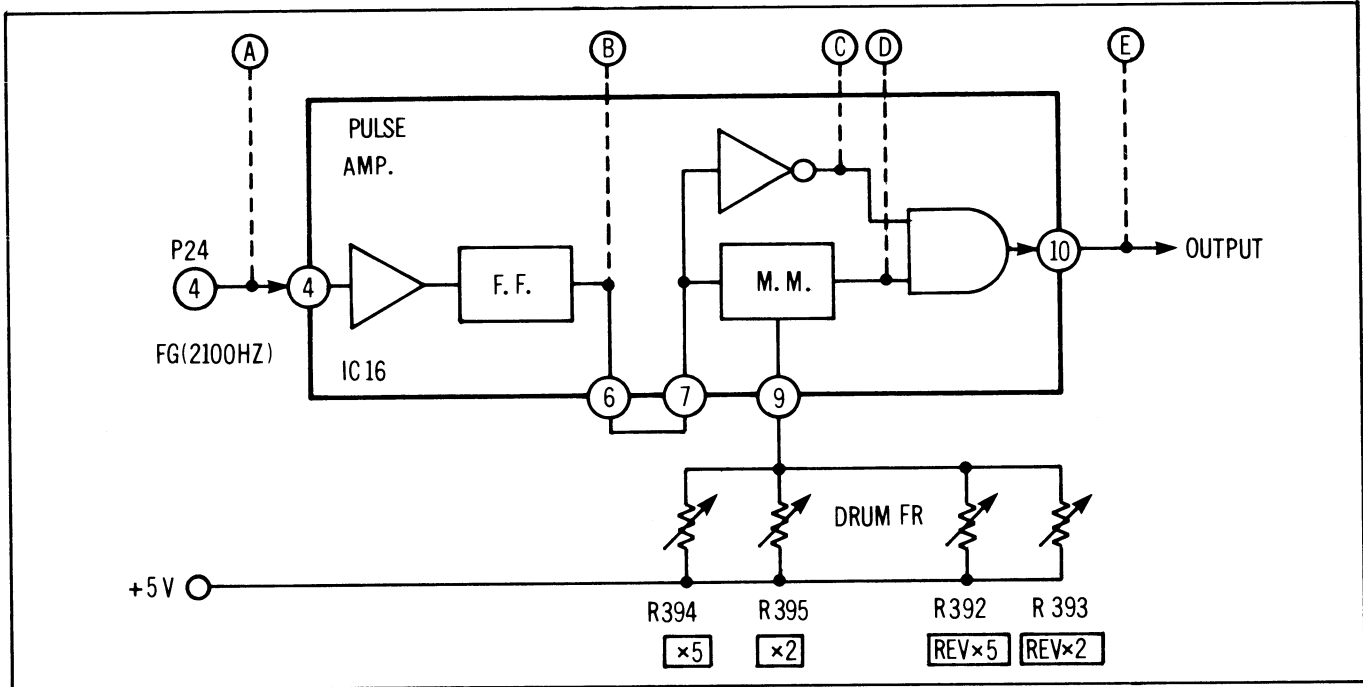


Figure 2-138

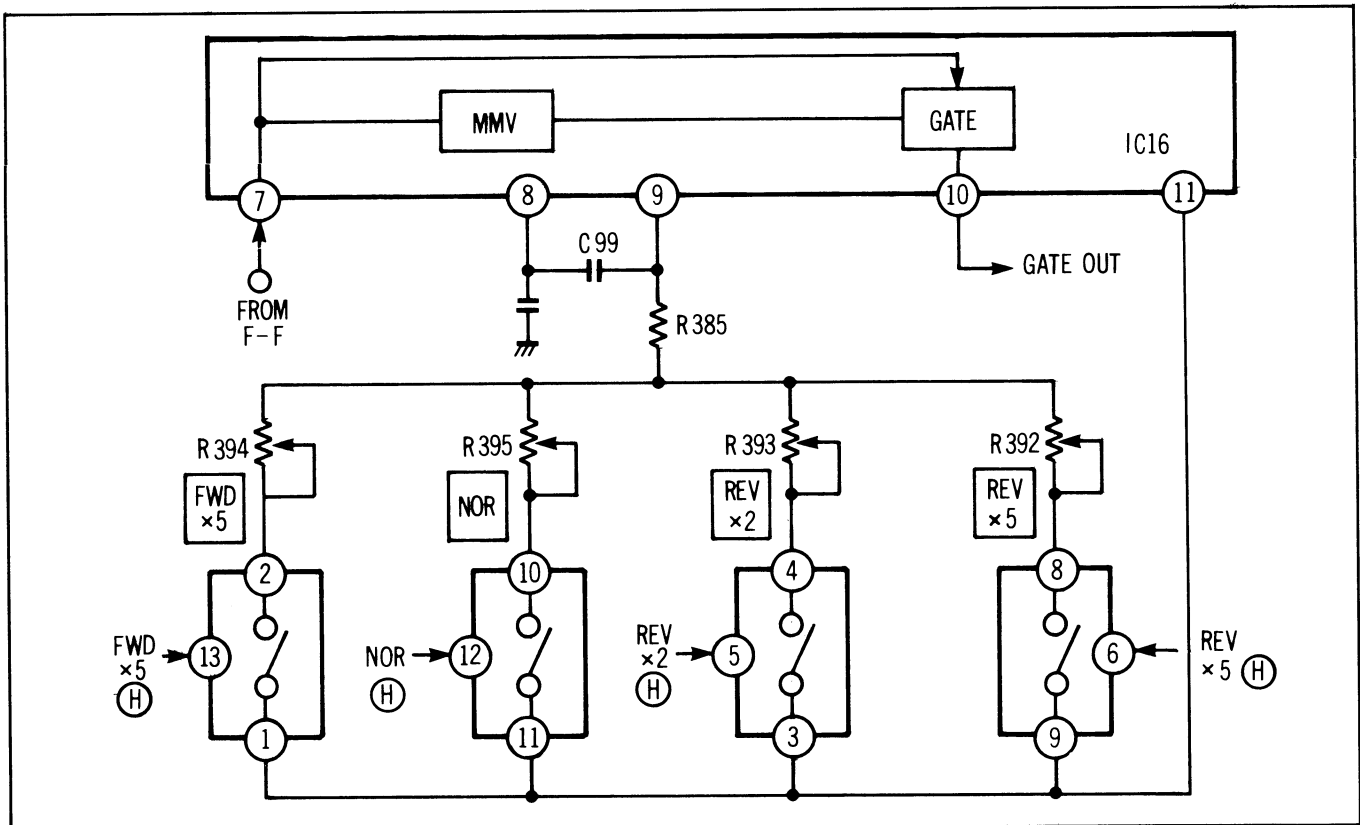


Figure 2-139

This is a classic self-gated multivibrator circuit.

Time T2 is determined by the period of the monostable, set by the Drum Free Run resistors. Since the tape speed can be selected in 10 speeds (X5, X2, X1, 1/5, 1/20 and Reverse), Drum F.R. adjustments are required to correct the cylinder speed as tape speed changes.

The respective drum F.R. adjustments are performed by R394, FWD X5; R393, REV X2; and R392, REV X5; in addition to X1, R395, as shown in Fig. 2-139. T1 changes inversely with motor speed. Therefore, "t" also changes with motor speed. As the speed increases, "t" becomes wider, and as the speed decreases, "t" becomes narrower. The output of the AND gate is supplied to a trapezoid network which consists of Q40, Q41, Q42, R338 and C110. And after passing through an emitter follower (IC18), the trapezoid is peak sampled and held by IC15, C112 and IC18.

IC15-(10), (11) is turned on by the gate pulse from MMV IC17-(10), (11). See Fig. 2-140. The output of this sampling circuit is integrated by C112, which produces an approximately 5 V DC signal, and an AC signal whose level varies with the pulse width "t". See Fig. 2-140.

Normally, only the AC signal is then applied to IC18-(5) which serves as a AC amplifier (10 dB) to improve the load characteristics.

The IC switch IC15-(1), (2) between IC18-(1) and R372 provides a path for the DC component developed in the sample and hold to the drive circuit. This switch is off when the servo is locked, and is on when the servo is unlocked and during the X2, X5 mode.

The speed servo signal is then applied to the Cylinder Motor Drive Circuit (VEP0299).

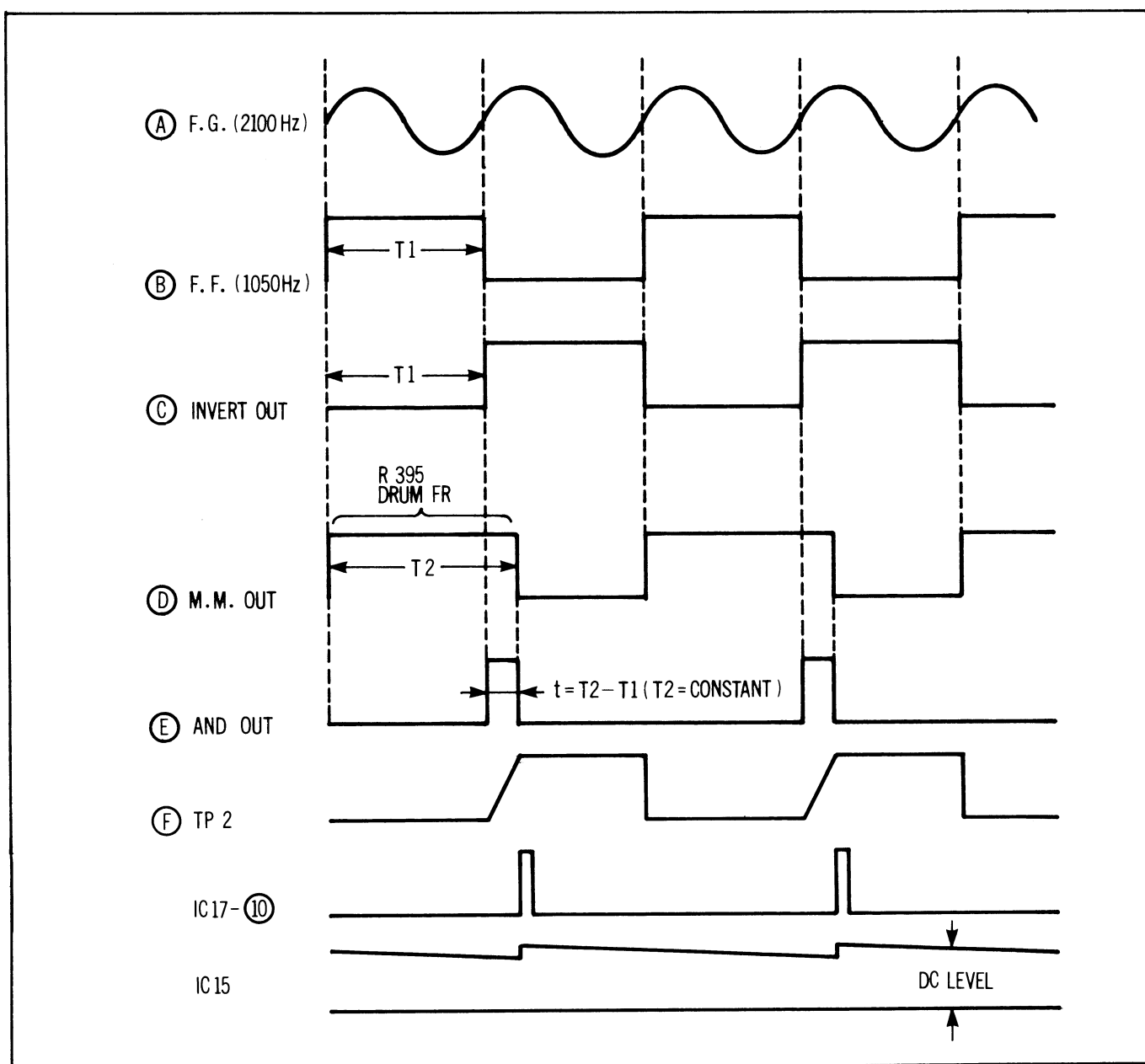


Figure 2-140

● PHASE CONTROL

① VIDEO IN
(P240-2)

② V. SYNC. SEP.
(IC 12-13)

③ 1/2 COUNT DOWN (TP 13)
(IC 12 ⑨)

④ 50 % DUTY M. M. V. (TP 6)
(IC 12 ⑧)

⑤ TRAPEZOID (TP 1)
(IC 16 ⑰)

⑥ DET 1 (P241-2)
(LEFT)

⑦ SW M. M. V. (1)
(IC 22 ⑭)

⑧ SAMPLING M. M. V.
(IC 22 ③)

⑨ SAMPLING PULSE (TP 3)
(IC 17- ⑦)

⑩ SAMPLING HOLD OUTPUT
(IC 16 ⑫)

⑪ CYLINDER SERVO OUTPUT
(P238- ①)

● SPEED CONTROL

⑫ DRUM F. G.
(P241- ④)

⑬ 1/2 COUNT DOWN
(TP 5)

⑭ SPEED CONTROL GATE
OUTPUT (IC 16- ⑩)

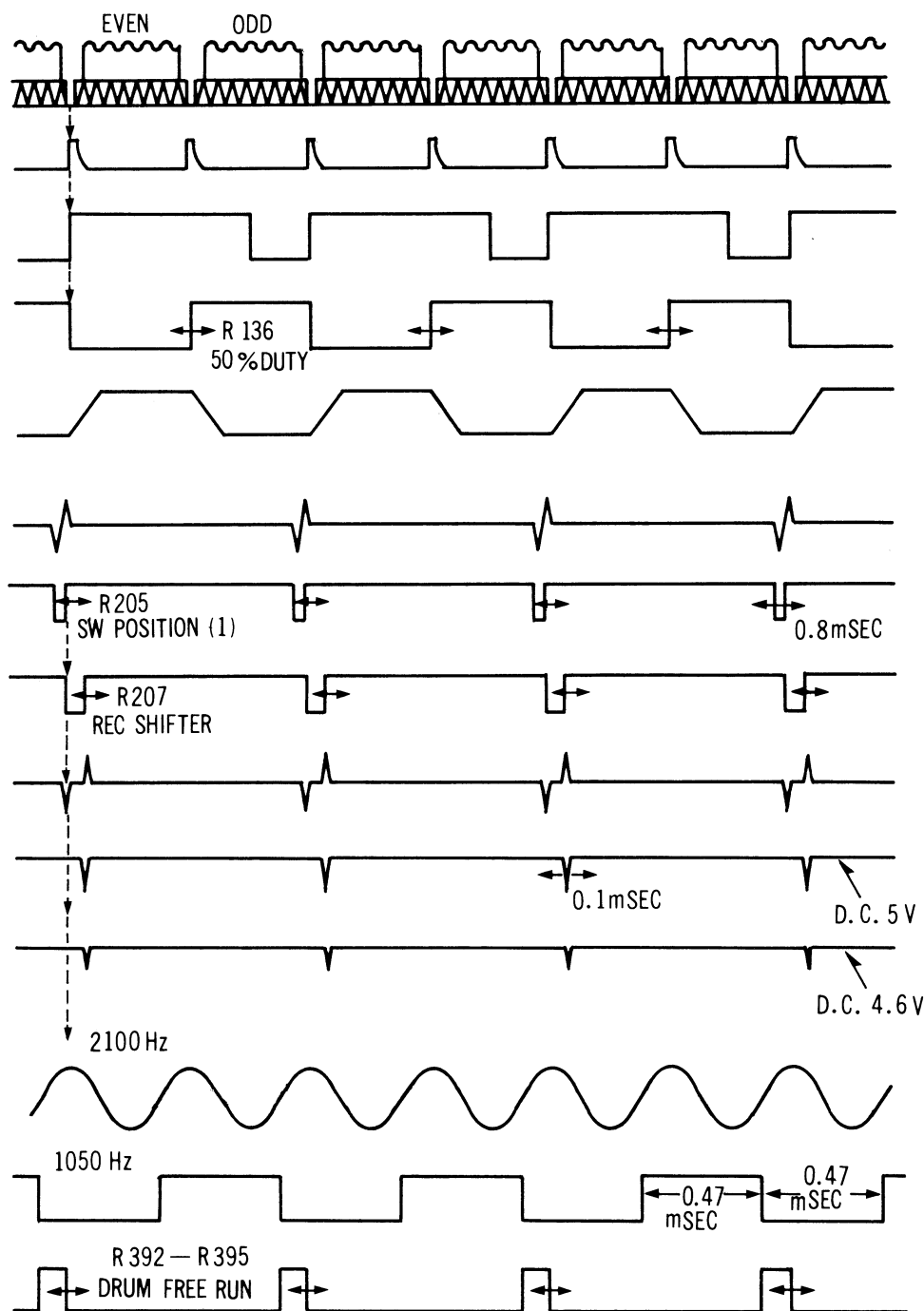


Figure 2-141

Servo Lock Circuit

This circuit generates a low when the servo is close to lock. The reference signal from IC12-(8) is supplied to the base of Q46, inverted, and applied to Q47. The head switching pulse is supplied to the base of Q48. As a result, a pulse whose width represents the phase difference between the reference signal and the head switching pulse appears at the collectors of Q47/Q48. Then the pulse is integrated by R349 and C114 (See Fig. 2-142). Since the integrated

voltage is too low at servo lock to turn Q49 on, a high appears at IC18-(8). This high turns Q50 on and a low at P242-(1) to the lamp drive detect circuit on the Capstan/Cylinder drive board (VEP0299).

If the servo is not locked, a higher integrated voltage appears at IC18-(9) and so a low appears at IC18-(8) which turns Q50 off. This turns IC15-(13) on and the DC level is mixed with the cylinder speed AC output to improve servo lock response time.

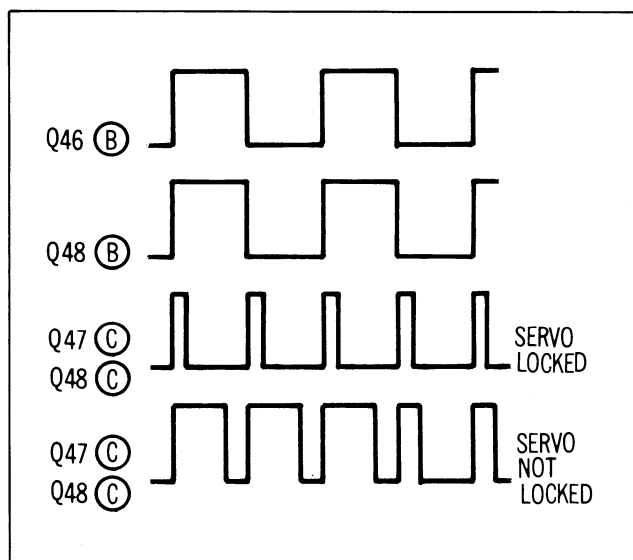


Figure 2-142

Speed Select Circuit

It is not necessary to adjust the Cylinder for each speed, but only for the greatest speed changes. In FWD X5 mode, the time constant of MMV, IC16-(7), (8), (9) is decided by C99, R388 and R394. In FWD X2 mode, normal X1/5, X1/20, REV X1, REV X1/5 and REV X1/20, the time constant is decided by C99, R388 and R395. In REV X5 mode, the time constant is decided by C99, R388 and R392.

In REV X2 mode, the time constant is decided by C99, R388 and R393.

Respective speed selector which consists of IC21 (A), (B), (C) and (D) are switched by the switching signal. The switching signal is produced by the gate circuit which consists of IC19 and IC20. (See Fig. 2-139).

60 Hz Buffer Oscillator Circuit

This circuit, which consists of Q17 and Q19, is a free-running multivibrator with a period of 57.5 Hz, but normally it is locked to 59.94 Hz by the separated sync signal.

If a V sync pulse at Q16-(C) is missing for any reason (noise, etc.), a 57.5 Hz pulse is added to replace the missing pulse and keeps the servo error minimal by preventing complete unlock. See Fig. 2-143.

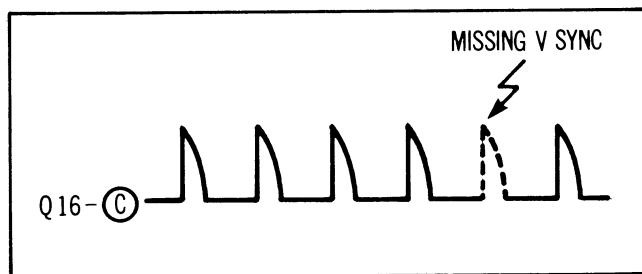


Figure 2-143

Sync Selection Circuit

Normal Mode

Vertical sync signal taken from the video input signal is used for both Record and Play. In the Normal mode, Q20 is cut off and the V sync signal is passed by D48. This turns Q21 and Q22 on. Therefore, a high appears at the bases of both Q23 and Q18, which turn on. Q23 shunts the INT 60 Hz signal to ground, and Q18 defeats D49 from inhibiting the normal path to IC12-(12) through Q16, Q15, etc.

If no vertical sync is present, the lack of signal at D48 causes this circuit to turn off Q23 and enables Q24 to pass the internal 60 Hz signal.

Internal (INT) Mode

Only the playback mode uses the Internal mode. A high at P240-(3) is supplied to both Q20 and Q16. Q16 turns on to defeat the buffer oscillator, while Q20 turns on so that the 60 Hz signal from IC12-(13) is grounded and the internal 60 Hz at P235-(8) is supplied to IC12-(12) through Q24 and D52. The internal 60 Hz comes from a count down circuit on the Capstan/Cylinder drive board.

If the INT mode is selected and record starts, the normal mode is selected automatically, because a high at P237-(5) turns Q14 on and the high at P240-(3) goes low, as if in the normal mode.

External (EXT) Mode.

A high at P240-(4) provides collector bias for Q249, which amplifies the external sync signal. R406 sets the level. That high also turns Q20 and Q23 on. Q20 defeats the separated sync from the input video signal and Q23 shunts the INT 60 Hz. Therefore, the EXT sync signal is supplied as a reference signal through the V sync integrator C51, R141, Q16, etc. Lack of an external signal does not cause a switch back to normal or internal.

ARTIFICIAL VERTICAL SYNC PULSE

GENERAL

When the unit is paused, a still frame picture will be produced if a video cassette capable of still frame is used (KCA). In pause, an inherent, stationary tracking error occurs because the angle of the head sweep across the tape changes when the tape is stopped, and the video heads actually scan a portion of blank tape which appears as noise. This noise can occur anywhere in the picture. If it happens during the vertical interval, vertical sync (hold on the monitor) may be lost. To prevent this, an artificial vertical pulse is inserted in the vertical interval.

Q35 and Q36 form a multivibrator to be used to generate this pulse. The same effect is evident during all other non-normal speeds, so the same circuit is used in all speeds except X1.

The head switching pulse from pin (8) of P246 (Sub Servo Board) is applied to a differentiator consisting of R218, C106, R397. The positive going excursions are selected by D62 and applied to the base of Q35.

The head switching pulse is also applied to differentiator consisting of C105, R320. The negative going excursions are selected by D61 and applied to the collector of Q35. In this way, the collector of Q35 goes low 60 times a second at the rising and falling edges of the head switching pulse.

This process turns Q36 off at the same rate. Q36 will again turn on however when C107 charges through R323 and R322.

The charge time is variable by R322.

The waveform at the collector of Q36 then is a series of positive going pulses of variable width. These pulses are then differentiated by R327 and C108.

The negative going portion will turn on Q37, from whose collector circuit the output is taken. During pause, when a low signal applied to D64 from terminal (1) of P237 turns off Q38, (which is on only in Normal (X1) mode) output occurs.

The duration of the artificial vertical sync pulse is about 200 μ sec, and it is adjusted by R322 to start 1 H before the appearance of normal V sync. If the unit is in the record mode the artificial vertical sync pulse will not be generated because D57 holds Q38 on.

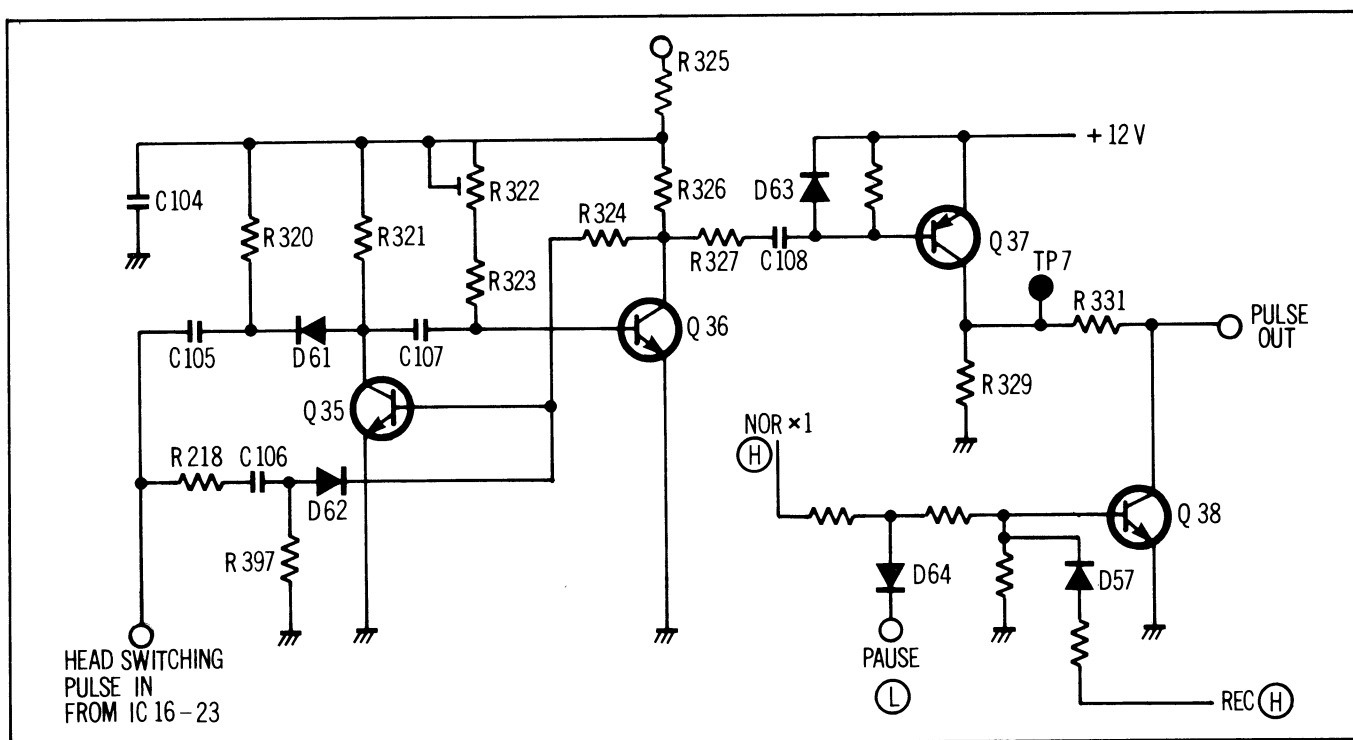


Figure 2-144

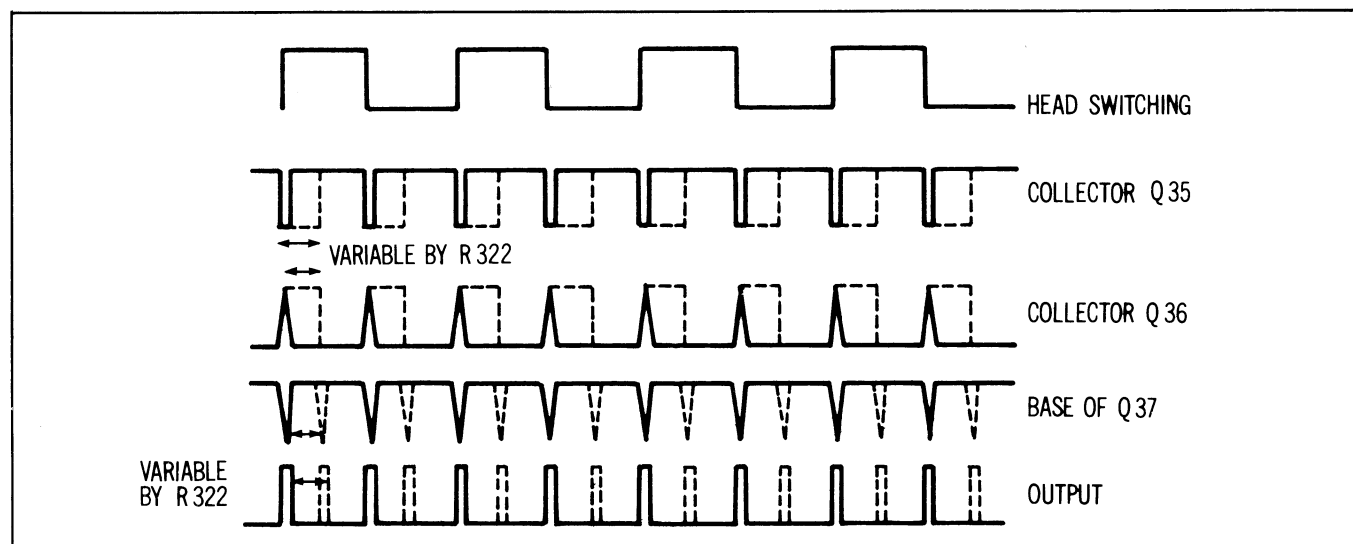


Figure 2-145

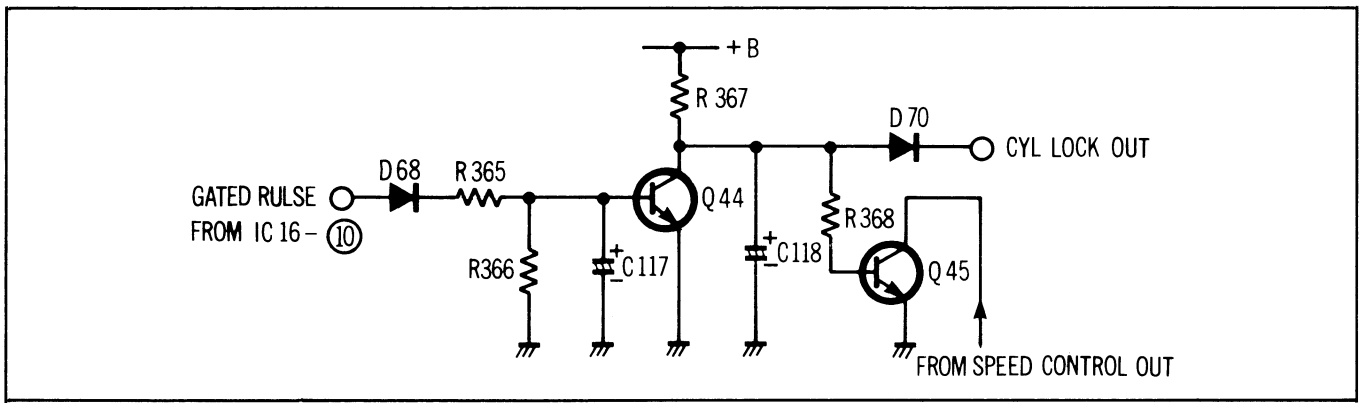


Figure 2-146

Cylinder Lock Protection Circuit

This circuit, which consists of D68, C117, Q44 and Q45 forms a protection for "cylinder lock", or lack of rotation of the head cylinder. Normally the gated pulse (t1-t2 described above) from the drum F.G. is integrated by D68, R365 and C117, and cause to turn Q44 on.

If the cylinder is stalled (stopped) for any reason, no gated pulse would appear and Q44 would turn off. Then +B through R367 is sent out as a CYL lock (H) at P238-(2). At the same time, Q45 would turn on to ground the CYL speed out signal to protect the motor from excessive drive (See Fig. 2-146).

2. CAPSTAN SERVO CONTROL CIRCUIT

1) GENERAL

A. Phase Servo-Recording Mode

During the recording mode, the capstan servo has as its reference signal the same vertical sync supplied from the incoming video signal as the cylinder. Since the capstan shaft is round, with no "correct" position, the comparison signal is a divided-down capstan frequency generator (F.G.) signal. As was described, the video signal appears at terminal (2) of connector P240 and is applied to IC12 where only the vertical sync portion is retained. That signal is then counted down by a monostable multivibrator within IC12 to become a 30 Hz pulse. This 30 Hz pulse is made into a 50% duty cycle square wave by the monostable multivibrator within IC10 (Pins (22), (18)), and then converted into a trapezoid by a trapezoid generator within IC10 (Pins (15), (17)).

The signal from the capstan F.G. is made into a sampling pulse by passing it through a divide by 25 circuit (IC3, IC4).

The trapezoid and the sampling pulse are sent to a sampling gate where the pulse samples the coincident value of the trapezoidal wave. The output of the sample and hold is a DC level equivalent to the instantaneous level of the trapezoidal waveform at the time of sampling pulse. This DC level, at Pin (12) of IC10, is the Capstan Phase Servo control signal, and it is summed with the Speed Servo control and sent to the Capstan drive circuit.

B. Phase Servo-Playback Mode

During the playback mode, the separated sync signal from the incoming video signal, the external sync signal, or the internal sync signal (supplied from the count down circuit) is taken from the Cylinder circuit and used as the reference signal. This is compared with a 30 Hz sample pulse which is derived from playback CTL pulses, rather than divided Capstan F.G. used in Record.

The CTL pulses are divided by 2 for the X2 mode, divided by 5 for the X5 mode, and the phase control portion is defeated (by Q10/D30) in the X1/5 and X1/20 mode.

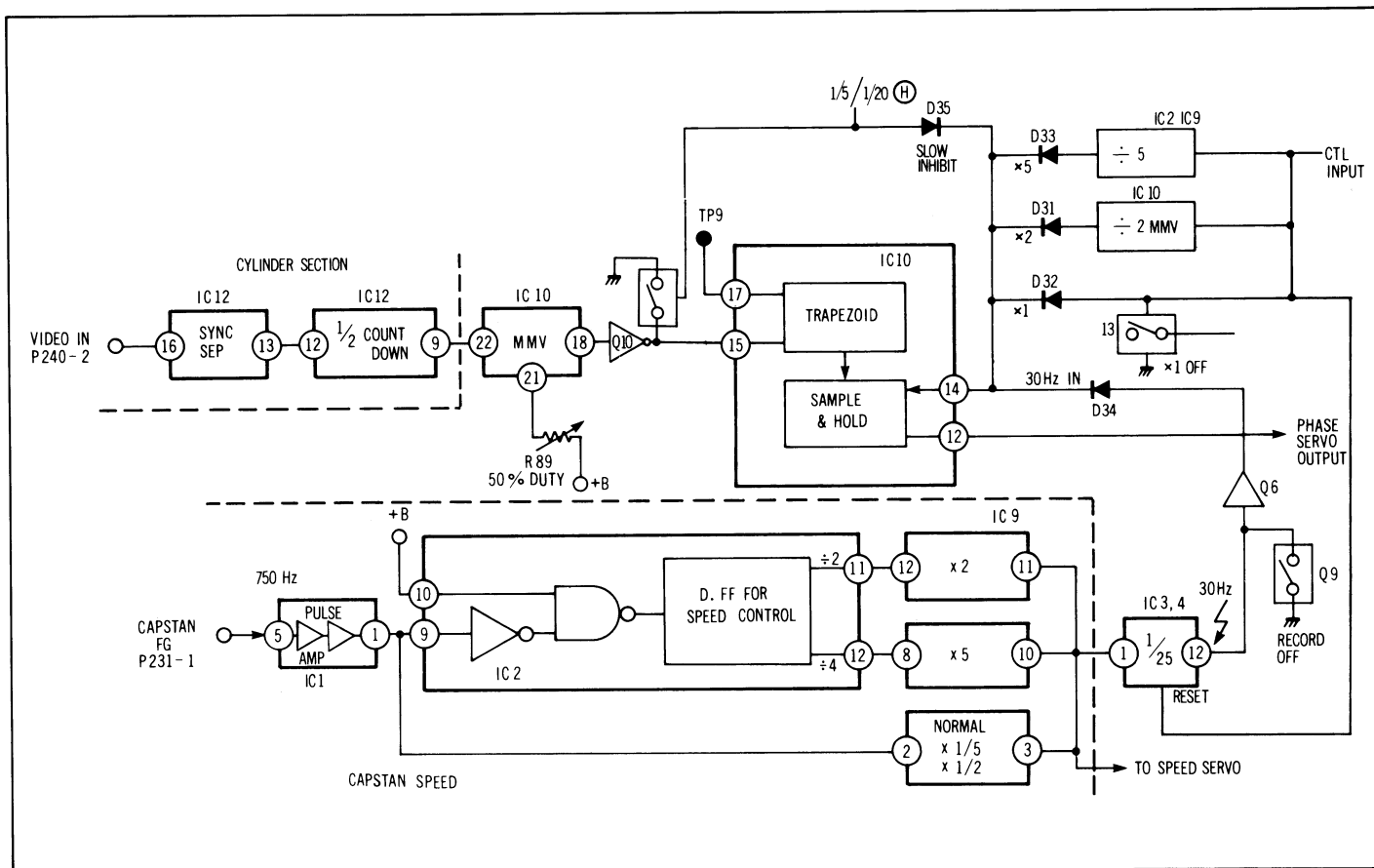


Figure 2-146

C. Speed Servo Record/Play

During the recording mode, the Speed Control functions to establish to correct speed of the capstan.

The capstan frequency generator (F.G) is a 750 Hz signal supplied from connector P231 to IC1 where it is amplified and shaped by a Schmitt trigger.

The pulses are then supplied to a divider for speeds X2 and X5 (IC2) and to a mode selector (IC9) which feeds the motor speed detector. The speed detector consists of a dual multivibrator, trapezoid, and sample and hold circuit which produces a DC error voltage which varies inversely with change of speed. Because of the multiple speed requirements, separate free run adjustments are switched by CMOS IC switches, as are separate trapezoid gain or charge current adjustments, also required because of the wide range of speeds. The output of the motor speed detector is the speed servo control signal, which is summed with the phase servo control signal. These combined signals are applied to a DC amplifier, and then sent to the capstan motor drive circuit. During the record mode, the speed servo control functions in the same manner as in Play, utilizing the mode selector for X1 speed selection only.

2) DETAILED CIRCUIT DESCRIPTION

A. Phase Servo Control Record

In the recording mode, the video signal which appears at terminal (2) of connector P240 is applied to Pin (16) of IC12 (AN301). As was described for the Cylinder the video signal is amplified, passed through the sync separator, and is applied to the vertical sync separator formed by R139-R141 and C50-C52. The separated vertical sync signal triggers a monostable multivibrator with IC12, whose duration is 23 ± 5 msec. Since the duration is longer than 16.6 msec, every other V. sync pulse is eliminated and the rate at the output of the monostable multivibrator is 30 Hz.

For the Capstan the output at IC12 (9) is differentiated by C20 and sent to Pin (28) of IC10, another monostable multivibrator. This shifts the reference to proper phase with the sample signal for tracking.

At IC10-(22), (18) a second monostable multivibrator produces a 50% duty cycle square wave by proper adjustment of its duration with R89. The 50% duty cycle square wave output is sent to Pin (15) of IC10 through inverter Q10. A trapezoid is formed inside IC10 to become the reference signal.

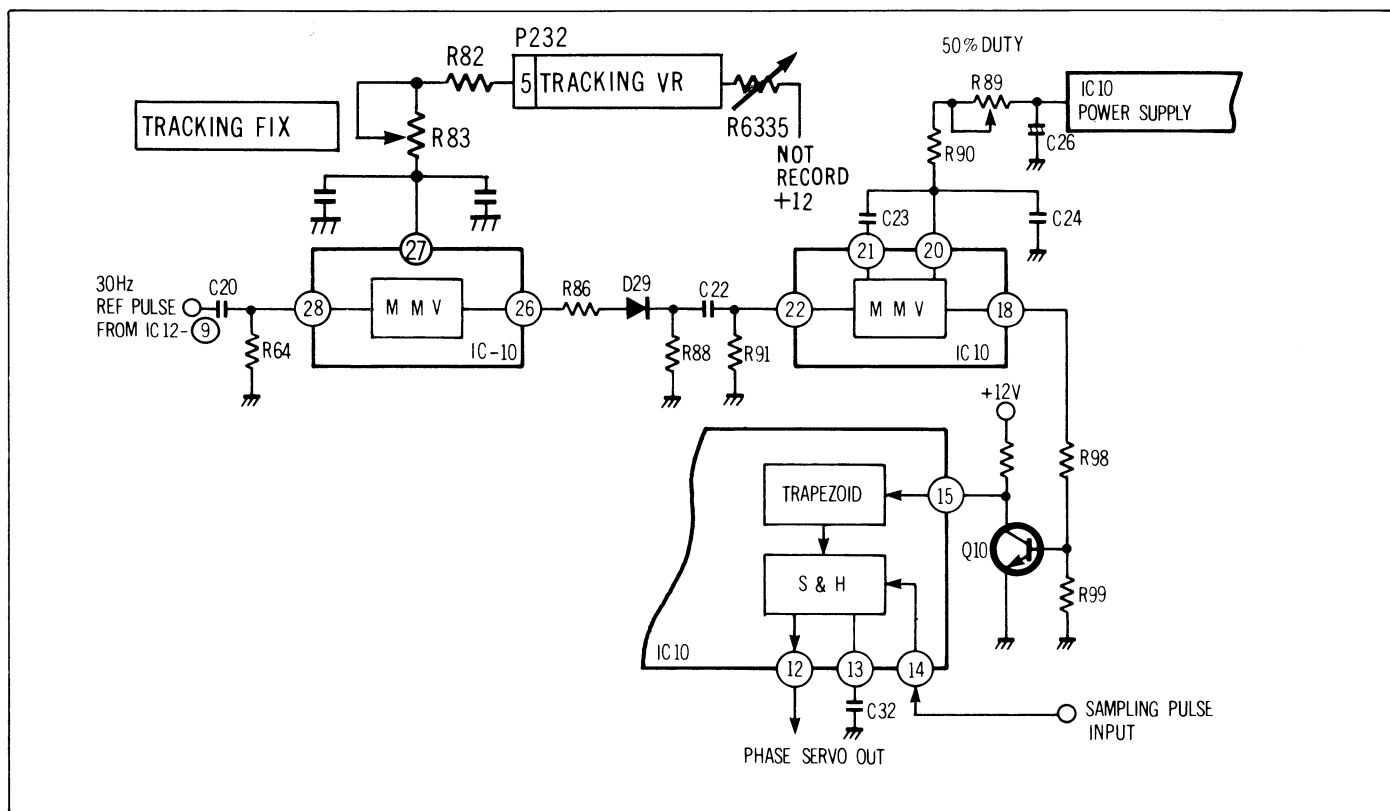


Figure 2-147

The sampling pulse is obtained from the capstan F.G. signal which is amplified and shaped by the operational amplifier IC1. The output pulse is applied to Pin (2) of IC9, which is the normal mode gate circuit. The signal is passed through IC's 3 and 4 to undergo division by 25 (F.G.=750 Hz). The

resulting 30 Hz signal is inverted by Q6, differentiated by C33 and R96 and applied to Pin (14) of IC10 through D34 as the sampling pulse. The sampling gate circuit inside of IC10 detects the level of the trapezoid at the time of sampling pulse, and stores that voltage in C32.

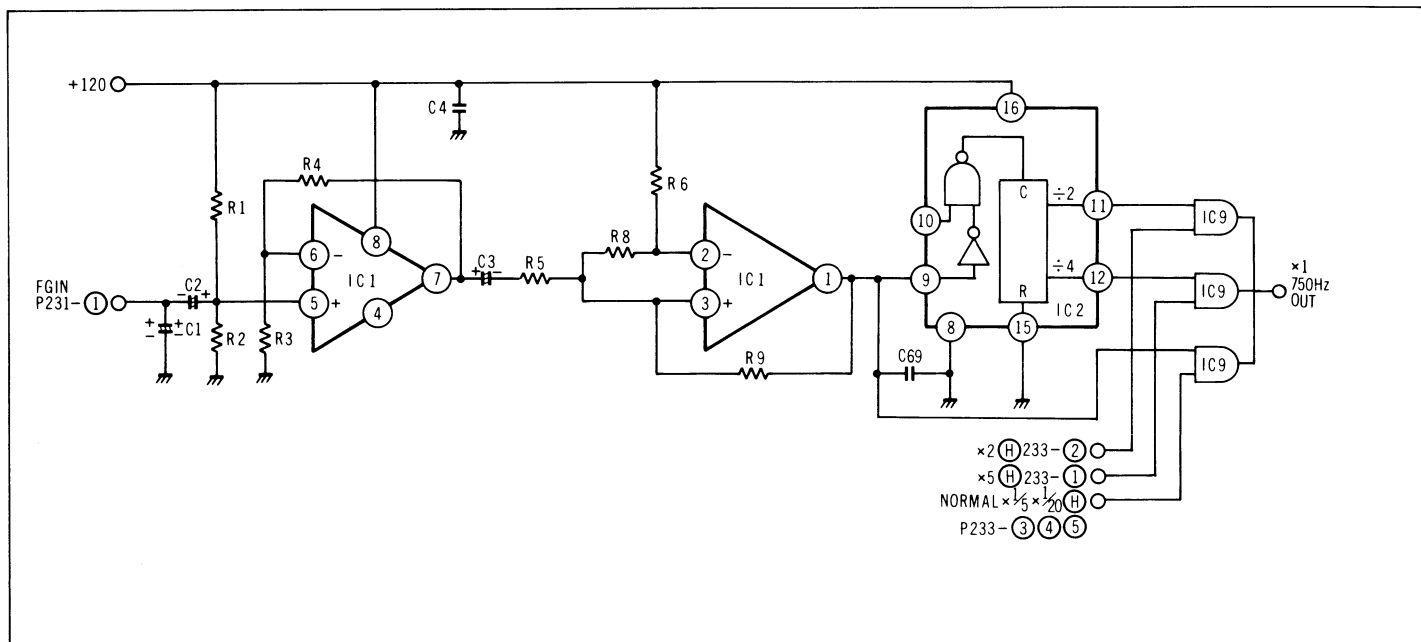


Figure 2-148

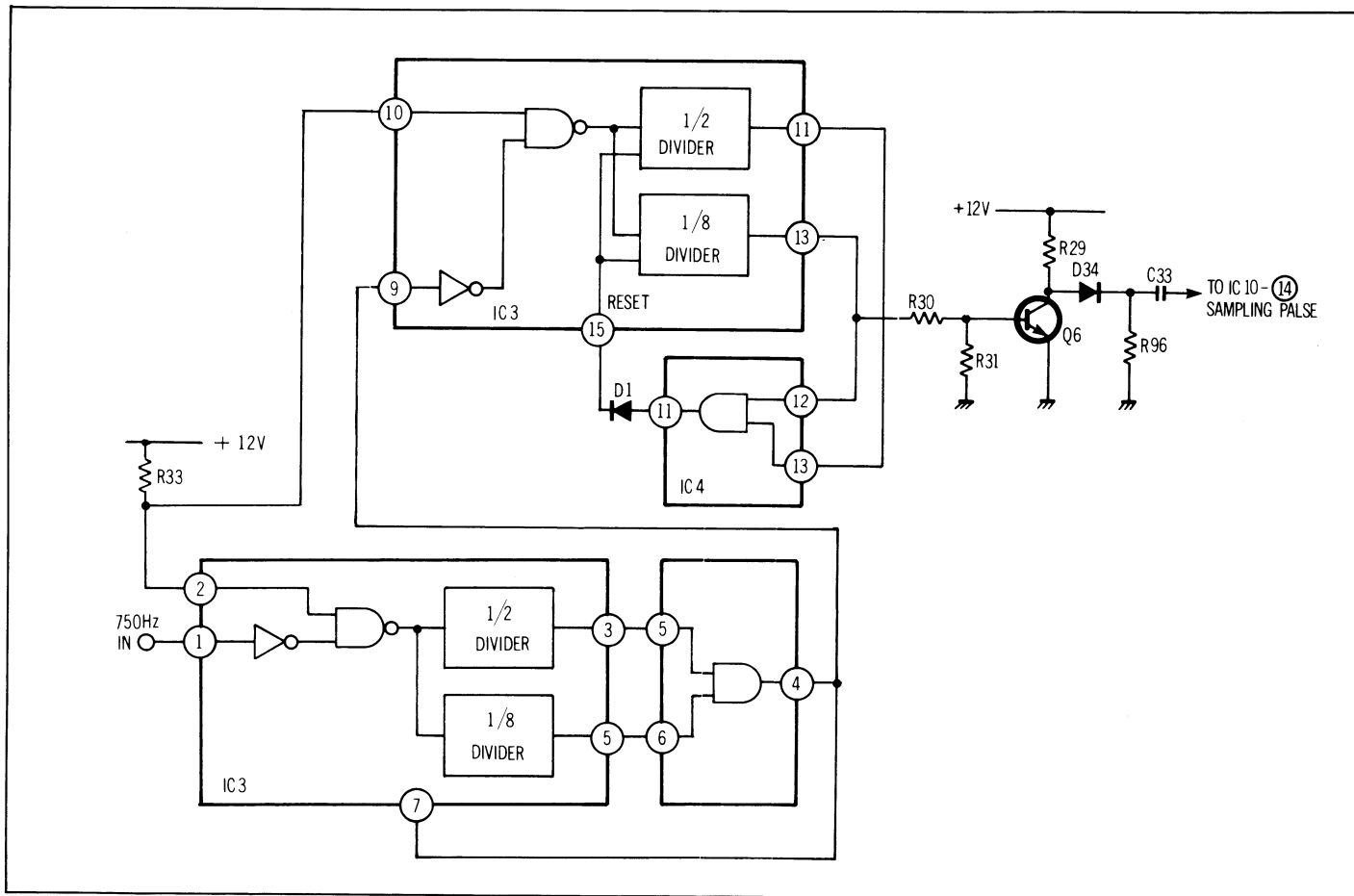


Figure 2-149

The output of sample and hold circuit is applied to a filter and limiter network consisting of R121, C38, D38 and D39. It is desirable to limit the phase sample and hold output because it may contain momentarily large error voltages as speed changes. If such voltages were passed, capstan servo "hunting" would occur.

A low pass filter (integrator) consisting of R121 and C38 forms the sample and hold voltages into a DC level. R120 sends the error voltage to be summed with the speed error signal. (See Fig. 2-150).

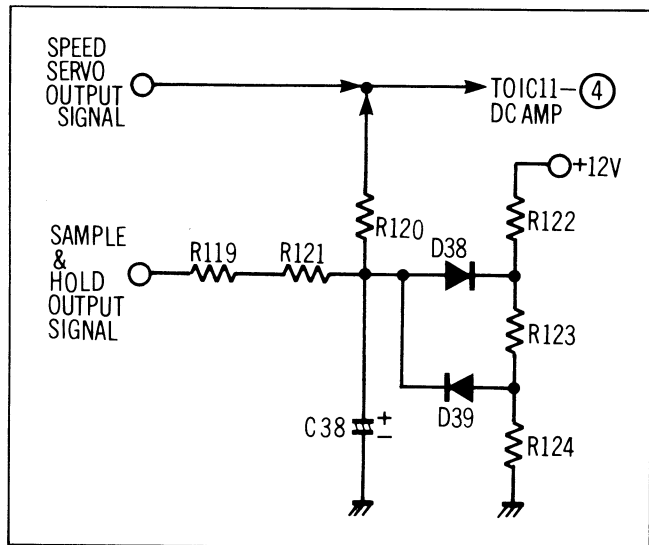


Figure 2-150

B. Phase Servo Control-Play

In play, either the separated sync signal from the incoming video signal, the external sync signal supplied from terminal (2) of P235 or the internal sync signal supplied from the down circuit is used as the reference signal. These signals are chosen by the sync mode selector as was described in the Cylinder section.

When the unit is placed in the Normal (X1) playback mode, the servo control functions in a manner similar to the Record mode, except in place of divided capstan F.G., the sampling pulse is formed from the amplified control (CTL) pulse which comes from P235-(7) through D32.

When the unit is placed in the X2 playback mode, the sampling pulse is formed from the amplified control pulse through a 1/2 count down within IC10-(7), (8) and D31. A high at P233-(2) (X2) turns Q13 on through D76 to defeat the normal path through D32. Q13 is also on in the REC/ ASSY mode. In X2, the position of the video noise band is adjusted by R93 so that the noise band will be placed in the upper third of the displayed image.

When the unit is placed in the X5 playback mode, the amplified control pulse is divided by 5 by IC2 and IC9. The resultant 30 Hz pulse is supplied to Pin (14) of IC10 through D33 to form the sampling pulse.

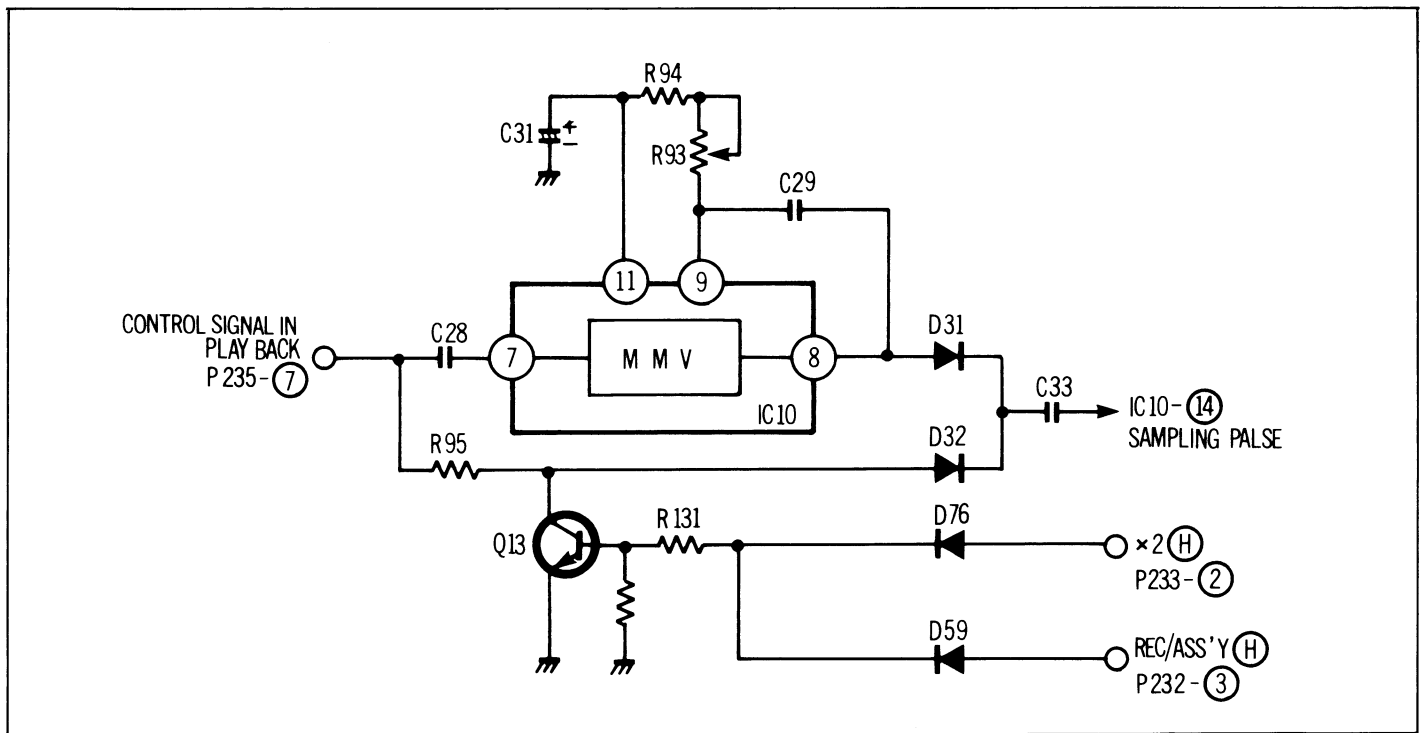


Figure 2-151

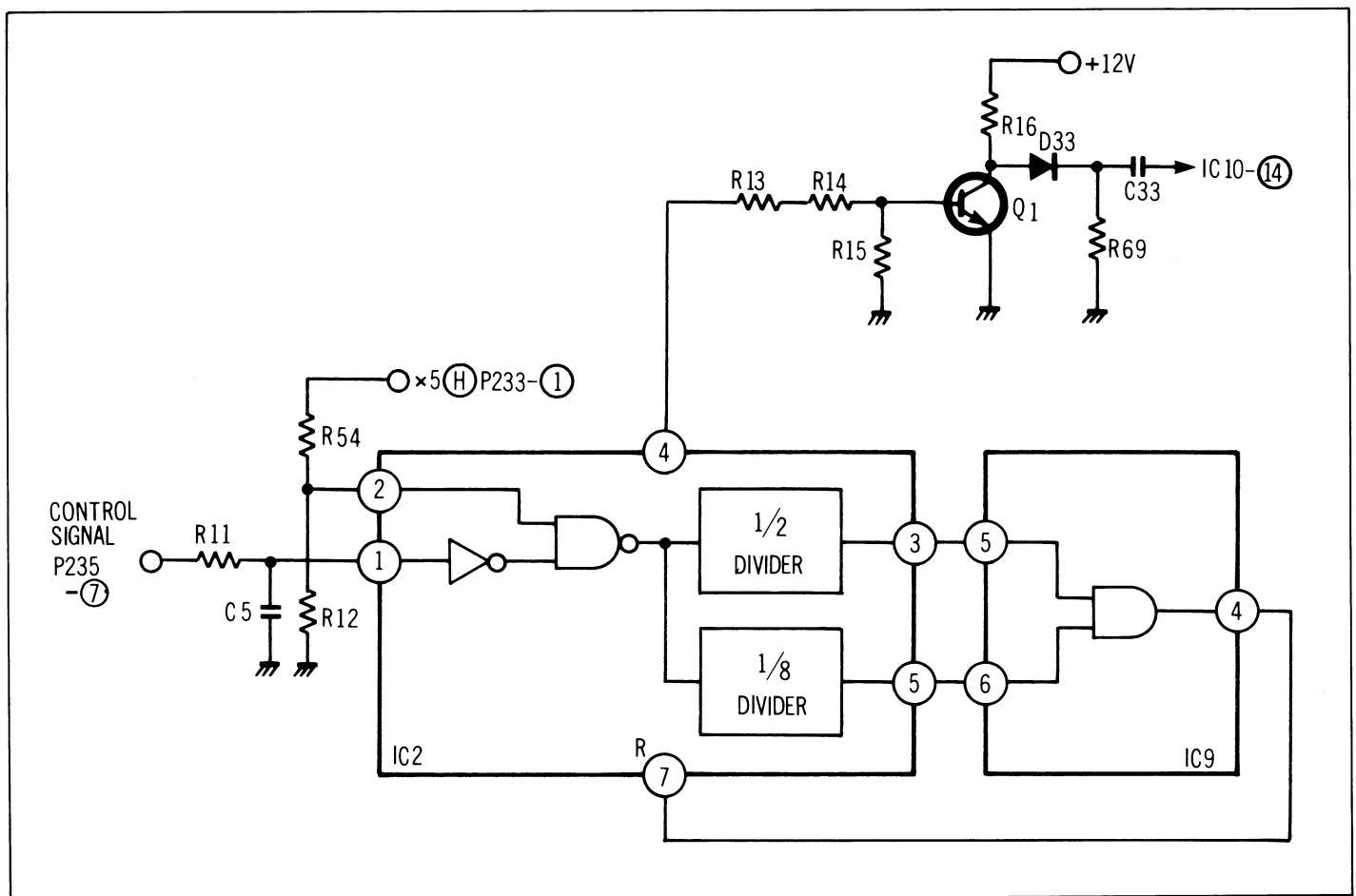


Figure 2-152

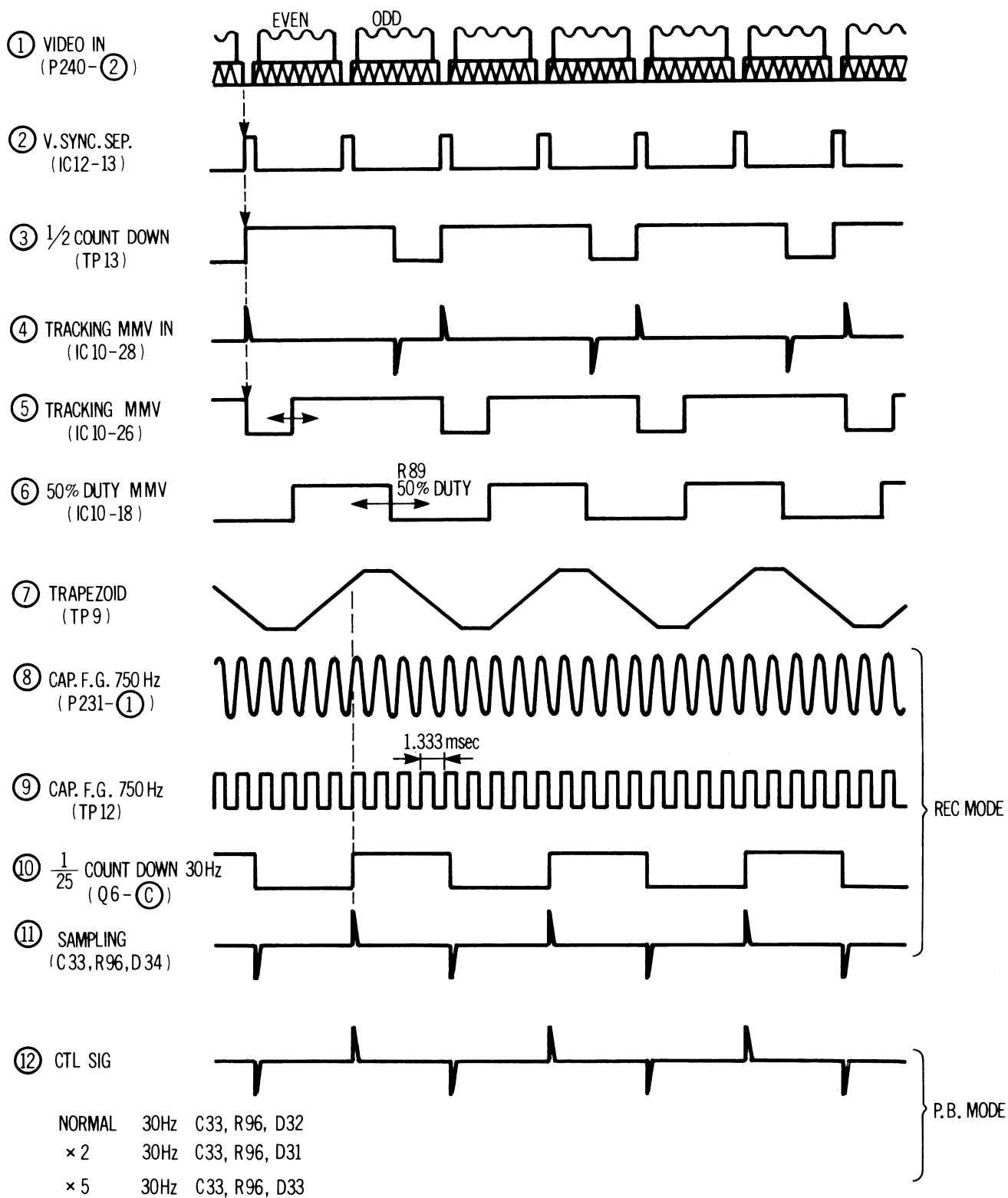


Figure 2-153

C. Speed Servo Control-Record

The 750 Hz sine wave capstan frequency generator (F.G.) signal is amplified at Pin (5) of IC1 and then at Pin (3) of IC1 it is shaped. The result is a 750 Hz square wave is passed to the gate circuit, which is IC9 (3). This 750 Hz square wave then separates into two paths; one is to the MMV (Q2, Q3), and the output of this MMV is differentiated by C8. This differentiated spike pulse triggers another MMV, inside IC5-(1). The delayed output serves as the input to a trapezoid generator inside IC5-(11). The second path for the 750 Hz goes to Pin (6) of IC5, which forms a sampling pulse for the sample and hold.

The output of the sample and hold is integrated by C37 which produces a DC signal whose level varies inversely

with speed. This DC signal is buffered by Q11, Q12 and supplied to a DC amplifier formed by IC11, where it is summed with phase system output.

D. Speed Servo Control-Play

Except for the X2 and X5 modes, the Speed Servo Control functions in a manner similar to that for the record mode.

In the X2 mode, the F.G. signal (1,500 Hz) is divided by 2 by IC2. In X5 mode, F.G. signal (3,750 Hz) is divided by 4. Since the X2 has exactly $\div 2$ in the F.G. path, the free run adjustment for X1 also serves for X2. However, since the X5 mode uses a $\div 4$ stage, the nominal 750 Hz is actually 937 Hz, and so a second free run adjustment is required.

Likewise, in the 1/5 and 1/20 mode, the capstan F.G. is 150 and 37 Hz, respectively, and separate adjustments are required for these speeds, making four total.

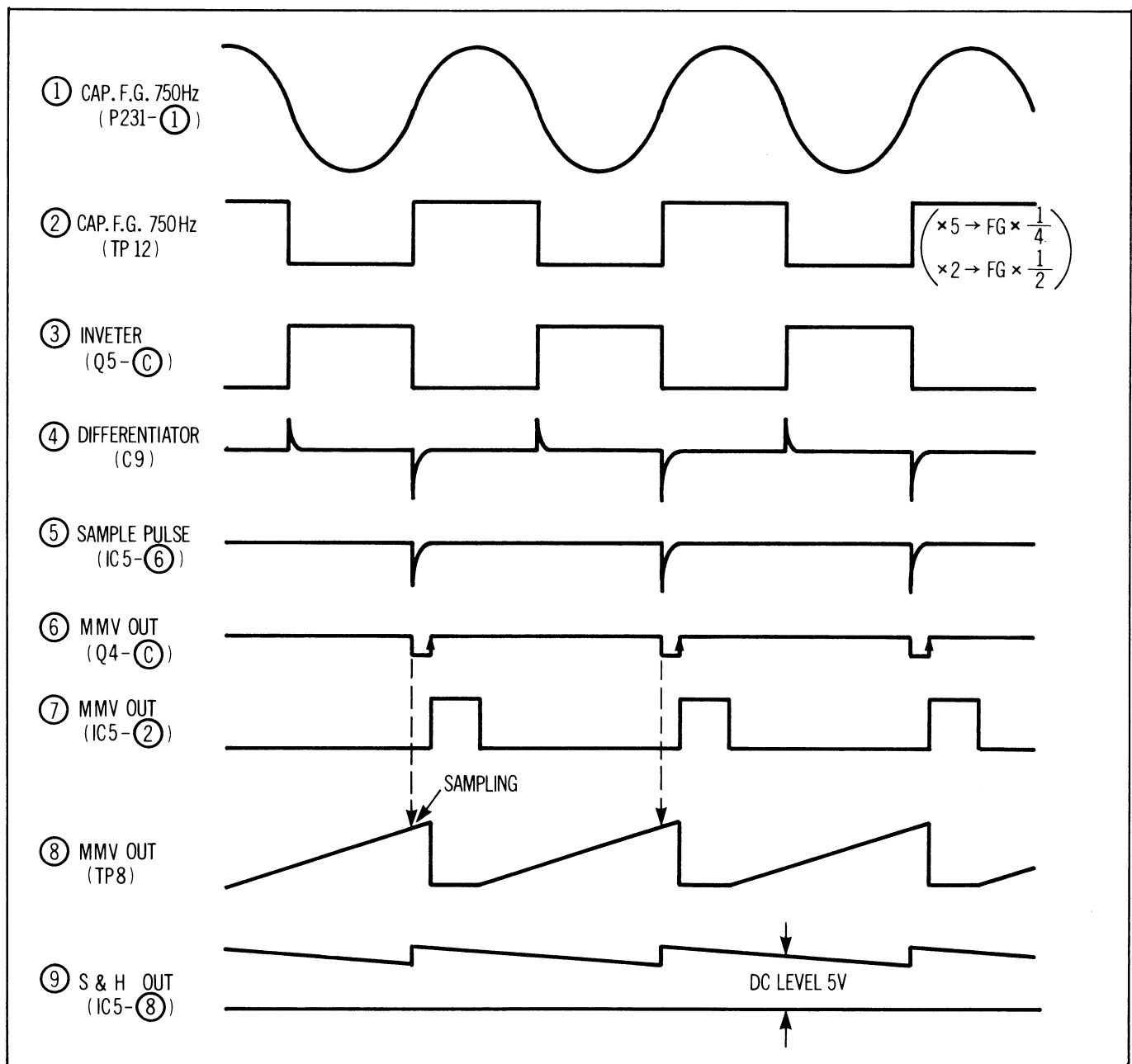


Figure 2-154

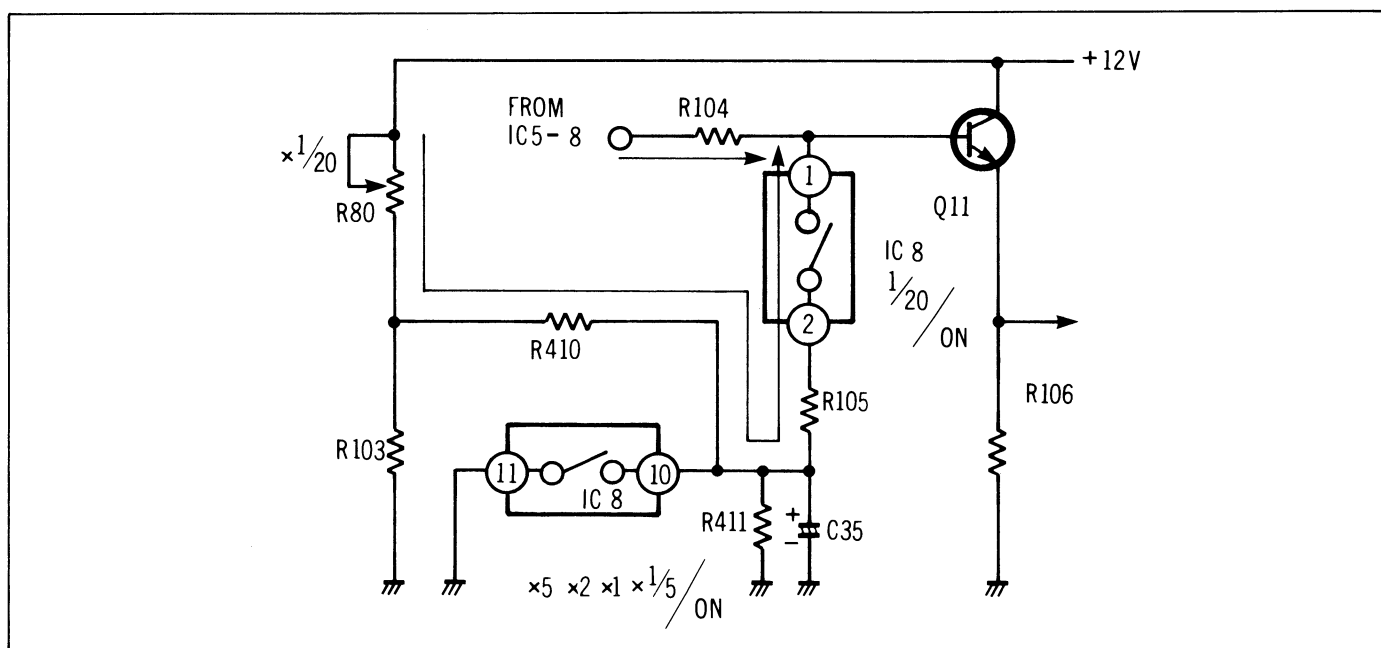


Figure 2-155

X1/20 mode

Additionally, in the X1/20 mode, the voltage divided by R80 and R103 is added to the output of the Sample and Hold, IC5-(8) through the switch IC8-(1), (2). Therefore, the switch IC8-(11), (10) will be closed except in the X1/20 mode and the switch IC8-(1), (2) will close only during the X1/20 mode, as shown in Fig. 18.

The capstan motor normally rotates at 300 r.p.m., so in the X1/20 mode the capstan rotates at only 15 r.p.m. or 0.25 r.p.s.

At this slow speed, it is difficult to create a steady speed, so this DC level is added. C35 shapes the response at the change to the X1/20 mode from other modes.

Since much lower drive voltages are required for the 1/5 and 1/20 mode, the switch IC8-(3), (4) is closed only during the X5, X2 and Normal mode. In X1/5 and X1/20 mode, the voltage at the emitter of Q11 is divided by R109/R110. In X5, X2 and normal mode, the voltage divided by R107 and R109/R110. (See Fig. 2-155)

In the higher speeds, the AC signal is supplied to Q12 through C34 and R108.

In the feedback path of IC11 the switch, IC8-(8), (9) will close to reduce the gain to unity in the slow modes (X1/5 and X1/20). In the X5, X2 and normal mode, IC11 gain is about 2.5.

Capstan Motor Lock Protection

The circuit, D6, C11, Q7 and Q8, is protection for the capstan motor.

Normally, the Capstan FG signal is integrated by D6 and C11 and the resultant DC level turns Q7 on, Q8 off.

If the capstan motor is stalled for any reason, no FG signal will appear at IC1-(1). Therefore Q7 turns off and +B through R66, R67 turns Q8 on.

This disables the trapezoid sample pulse, resulting in no speed servo output, and motor protection. See Fig. 2-156.

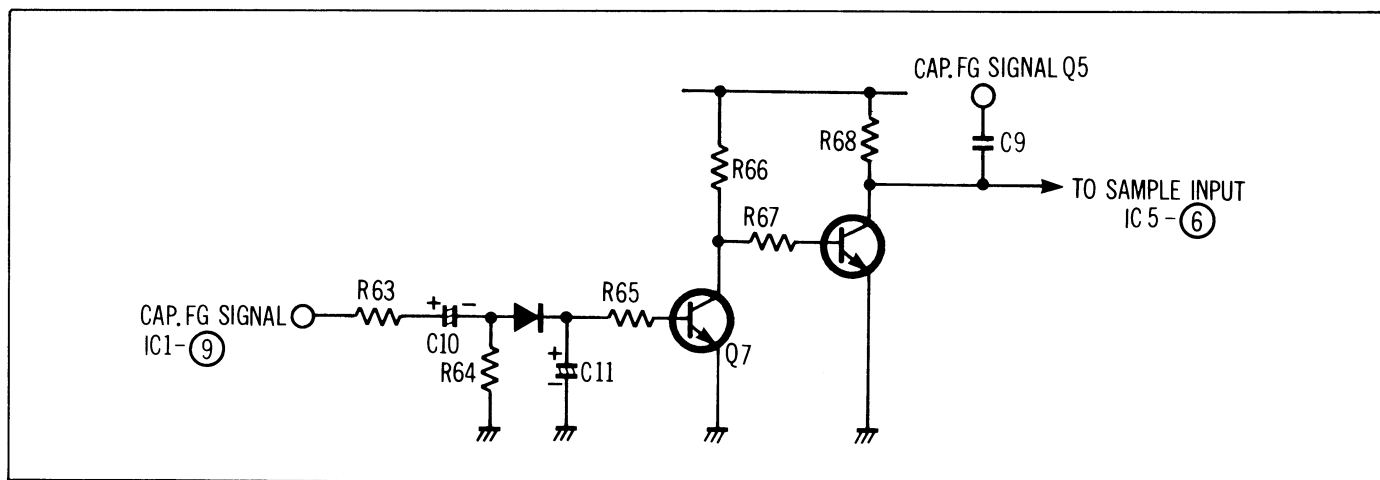


Figure 2-156

DETAILED CIRCUIT DESCRIPTION

A 50 kHz $\pm$ 10 kHz oscillator is formed by IC2 (18) and C24 and its output (TP4) is sent to the position coil primaries. Since the maximum signal transfer occurs when a magnetic shunt is directly adjacent to a coil, there are eight magnets, and the rotor rotates at 30 r.p.s, then the 50 kHz secondary signals rise and fall at a rate of $30 \times 8 = 240$ Hz, in three phases.

Because the position coils are spaced 120° apart, and the shunts are spaced 45° apart, when one coil has maximum signal, 15° later another coil will reach maximum, followed by the third coil 15° after that. For example, in the diagram (Fig. 2-157) positioning coil "A" has maximum signal because shunt 1 is directly adjacent. If the rotor moves clockwise, in 15° shunt 4 will be adjacent coil "B", followed by shunt 7 being adjacent to coil "C" in another 15° . The relationship between the outputs of the three position coils is shown in Fig. 2-159.

These signals are then rectified and sent through low pass filters, C26, C29 and C30 respectively. This removes the 50 kHz carrier and preserves the 240 hz portion in each signal. As shown in Fig. 2-160, each 240 Hz signal is out of phase by 15° .

Within IC2, each 240 Hz signal is sent through a level slice, which compares the two signals from the servo section with the 240 Hz level. If the 240 Hz signals are allowed to turn on the output drivers earlier (lower on the waveform) the motor will turn faster; if higher, slower. In this way, every 15° a different set of drive coils will receive maximum current, but the time for which the current is present will be set by the servo loop.

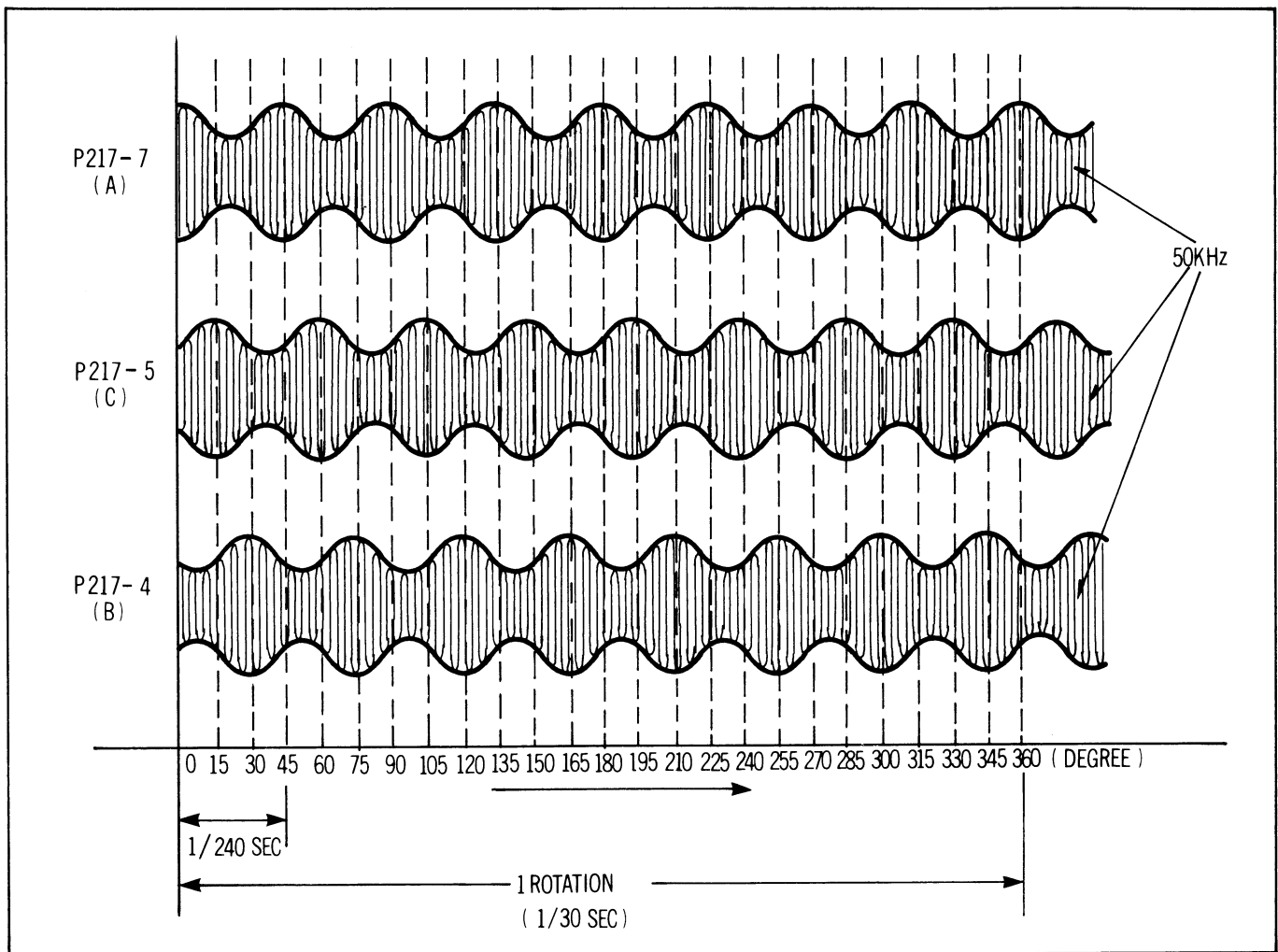


Figure 2-159

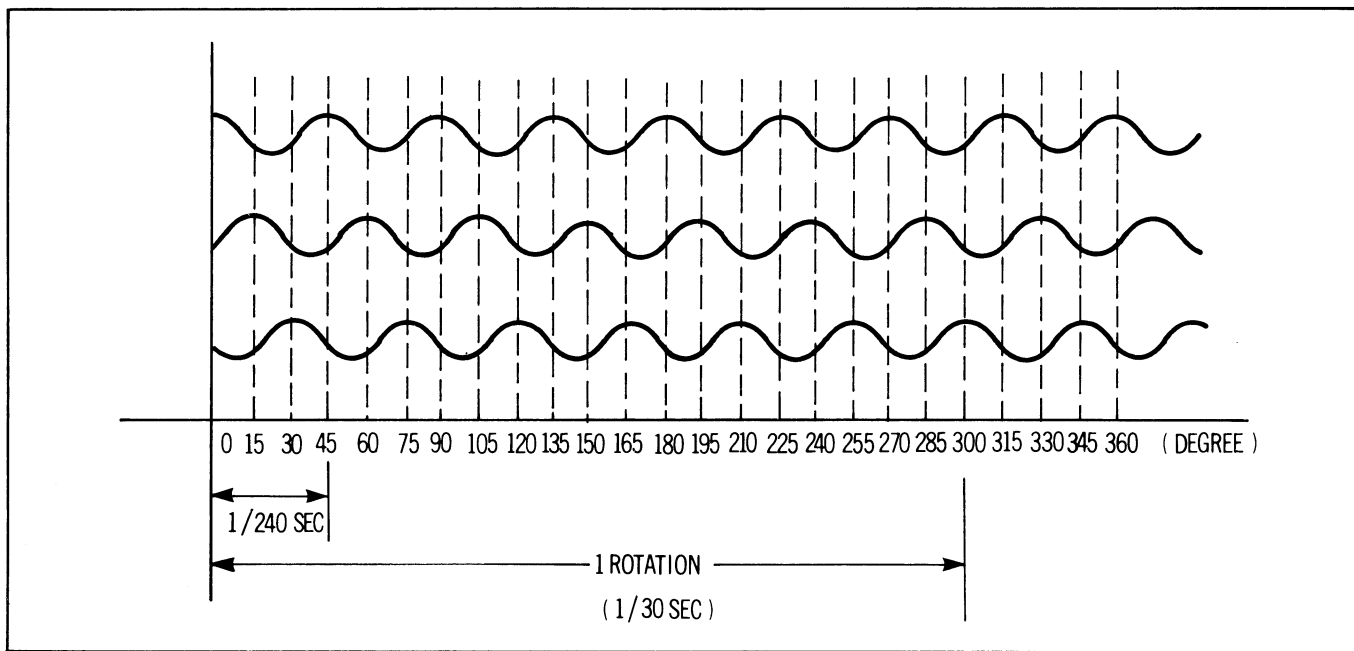


Figure 2-160

FG AMP.

The Cylinder frequency generator signal from connector P211-4 is amplified by Q1 and Q2. This amplifier has resonant frequency of 2100 Hz (L1 and C4) for maximum gain at the Cylinder FG center. Q3 performs as a ripple filter. See Fig. 2-161 and 162.

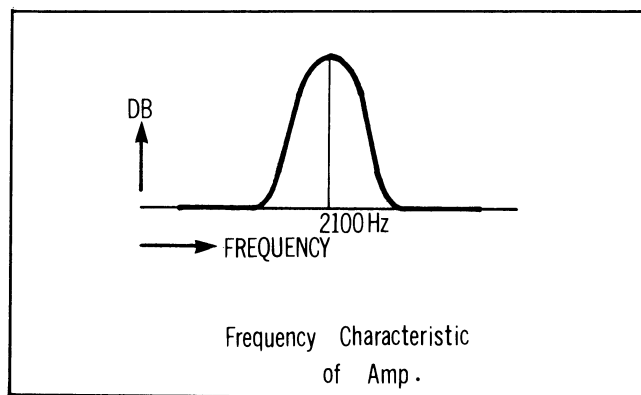


Figure 2-161

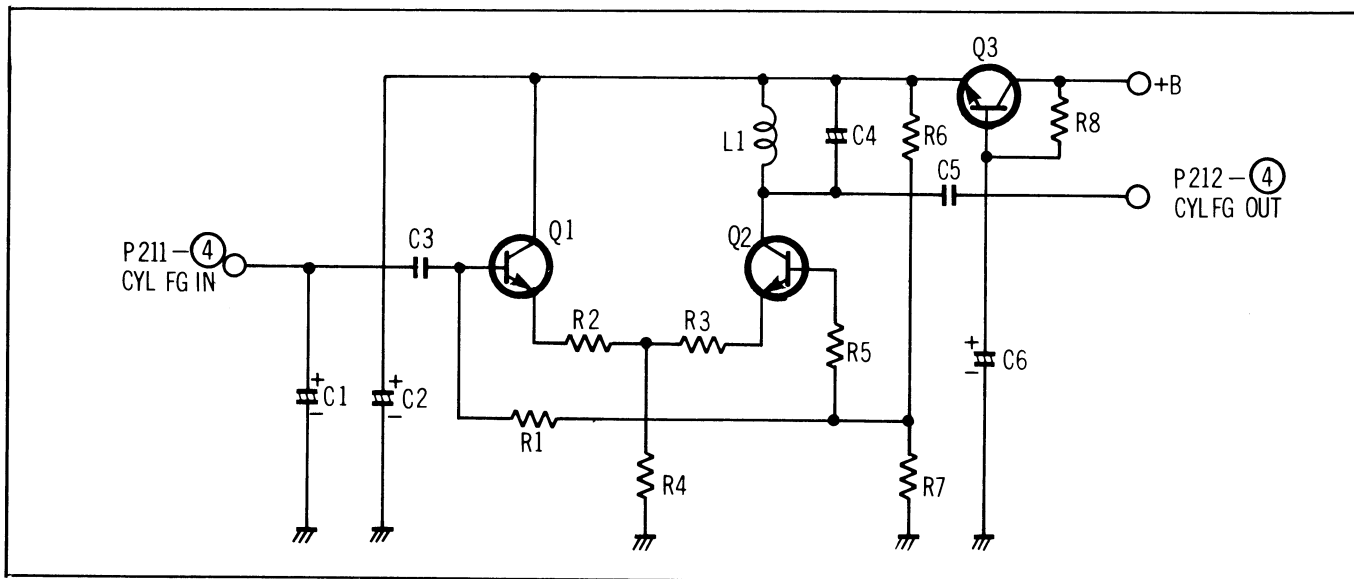


Figure 2-162

CONTROL SIGNAL AMP.

In the record mode, the control signal (CTL) from the connector P214-(1) is amplified by Q47 and Q4. The amplified signal is sent to the Control head through D1, D2 and the connector P213-(1). D1, D2 function as an automatic switch, since in playback the voltage level from the head does not exceed their forward bias.

In the playback mode, the control signal from the connector P213-(1) is amplified by Q5 and IC1 and the output at pin (6) of IC1 is split.

One output goes out to the System control circuit through the connector P214-(3). This control signal is counted for the tape time display. The other goes to Q6 and Q7, which form a signal shaper. This control signal goes out the connector P214-(4) and serves as a sampling pulse for the capstan servo control circuit.

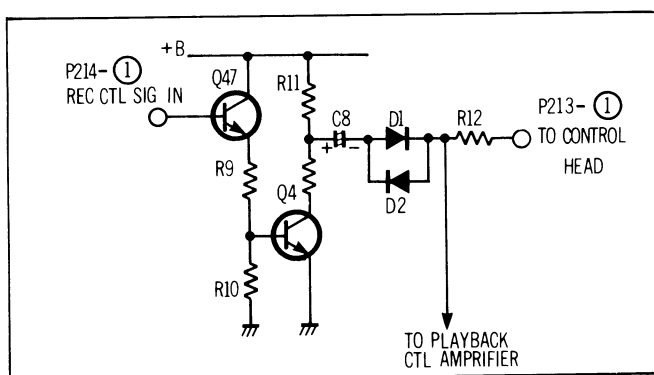


Figure 2-163

SERVO LAMP CIRCUIT

This circuit lights the servo lamp during Play and Record if both the cylinder and capstan servo are locked.

The 30 Hz reference pulse from the Servo system Q10 to connector P215-(5) is supplied to pin (11) of IC3 through inverter Q13.

The rising edge of the reference pulse triggers the 2.5 msec. MMV which consists of IC3-(8)-(13).

Then the output pulse at IC3-(12) triggers the other MMV which consists of IC-(1)-(6) whose duration is 5 msec.

This 5 msec pulse serves as a data input of a D type flip flop which is IC4-(1)-(6). The Clock pulse at IC4-(3) comes from the connector P216-(1) through amplifier Q14 and Q15, and is the Capstan phase sample pulse.

If the sampling pulse occurs during the 5 msec window the servo is locked. A high appears at pin (1) of IC4, the Q output of flip-flop.

The reset input, IC4-(4), should be a low, which means the cylinder servo is locked. Cylinder servo (L) comes from the connector P215-(2) and is made in the Servo circuit by Q46, Q47 and Q48. A high at IC4-(1) turns Q16 on to light the Servo Lamp through connector P216-(3). Refer to the block diagram and the timing chart, Figure 2-164.

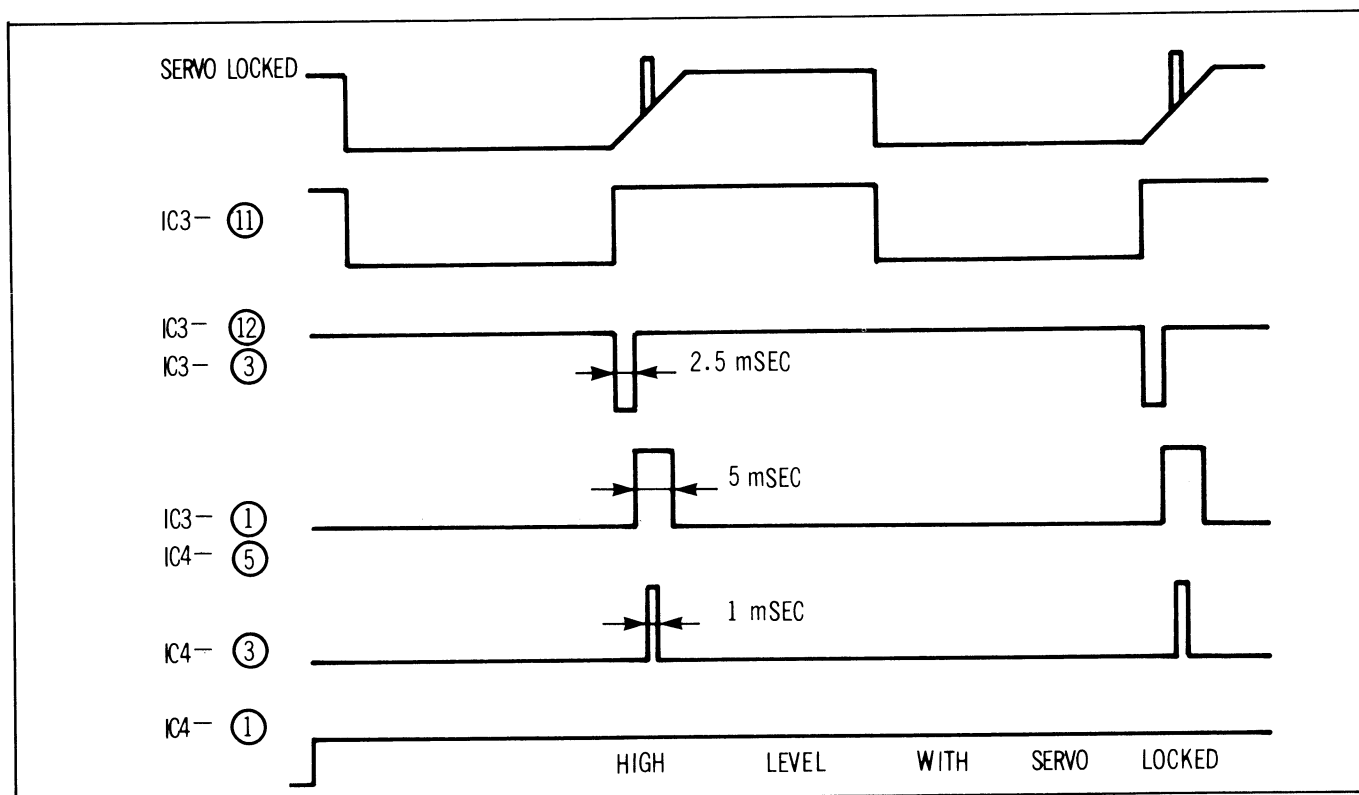


Figure 2-164

CAPSTAN MOTOR DRIVE

As was described above, the Capstan motor uses position coils, an oscillator and multiple drive coils. Like the Cylinder drive, there are three position sense windings spaced 120° apart, but in the Capstan there are only 6 magnetic shunt pieces, and the oscillator functions at 65 kHz.

Also, the cylinder used 4 sets of drive windings for each of three phases (12 poles). The capstan has three sets of three (9 poles) and, for additional torque, these are driven in a delta configuration rather than wye.

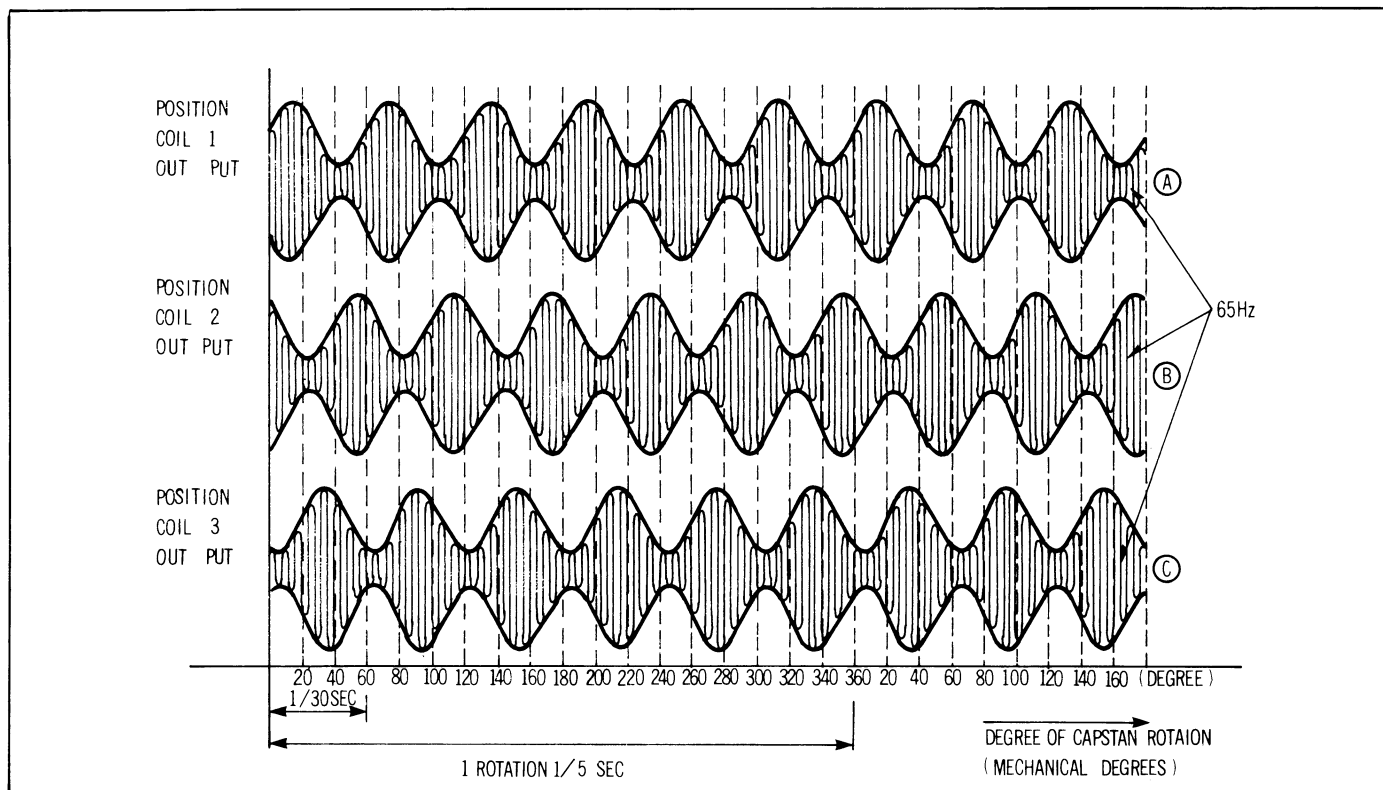


Figure 2-165

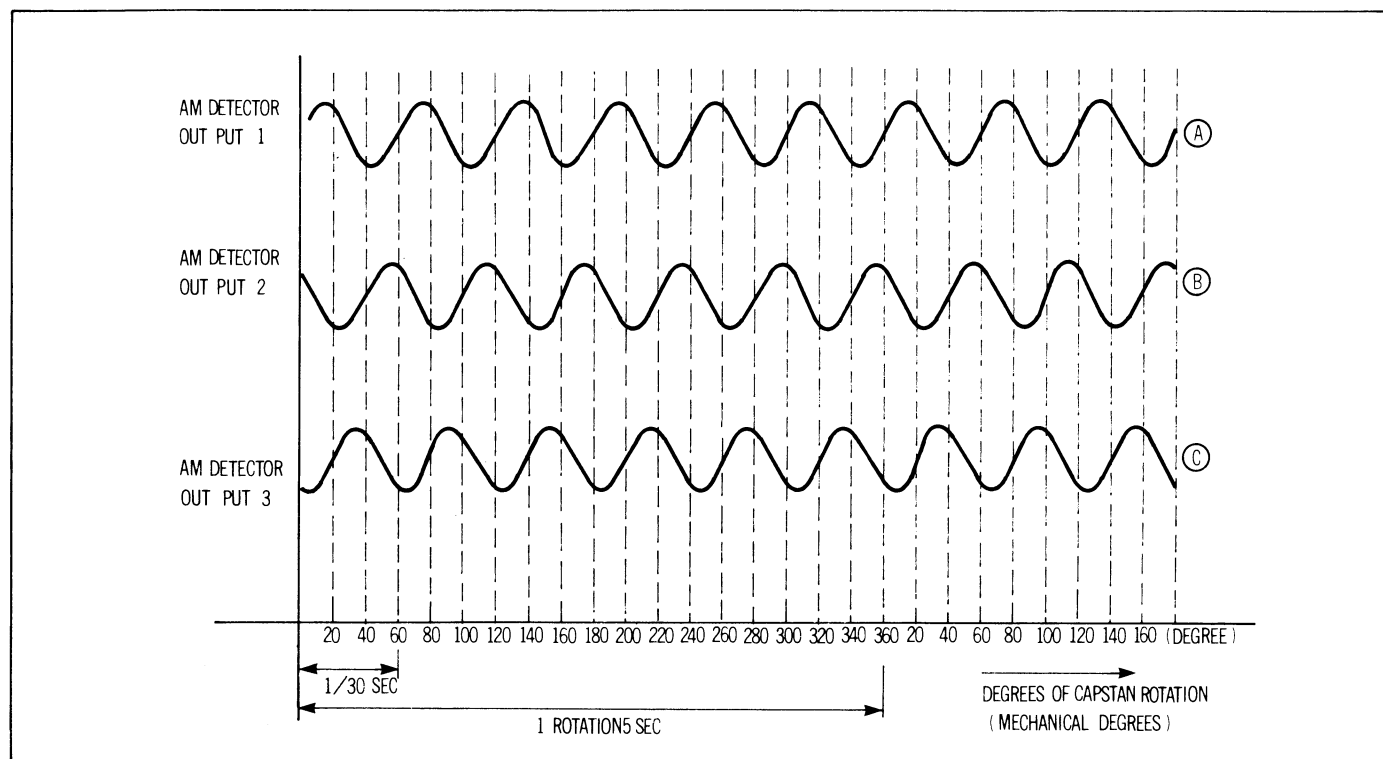


Figure 2-166

As the motor spins every secondary winding will have amplitude modulated 65 kHz signal present at its terminals. Since the motor normally spins at 5 r.p.s., each position coil will see 6 shunts per revolution to produce a 30 Hz amplitude modulated output signal.

Because the position coils are physically separated by 120° , the 30 Hz output of the 3 secondaries are displaced by 20° . Every time the motor turns by 20° , one of the secondaries will deliver a maximum output (See Fig. 2-166).

The three waveforms, A, B and C come from the output of three secondary coils. If the signals from the secondary coils are detected, the 65 kHz carrier will be eliminated, and just the 30 Hz signal will remain. Showing all three output signals simultaneously shows the relationship of the position coils.

Further, imagine the A, B and C waveforms applied to the base of the transistors within the IC. The main coil windings are shown 3 pole, but are actually 9-pole (See Fig. 2-167).

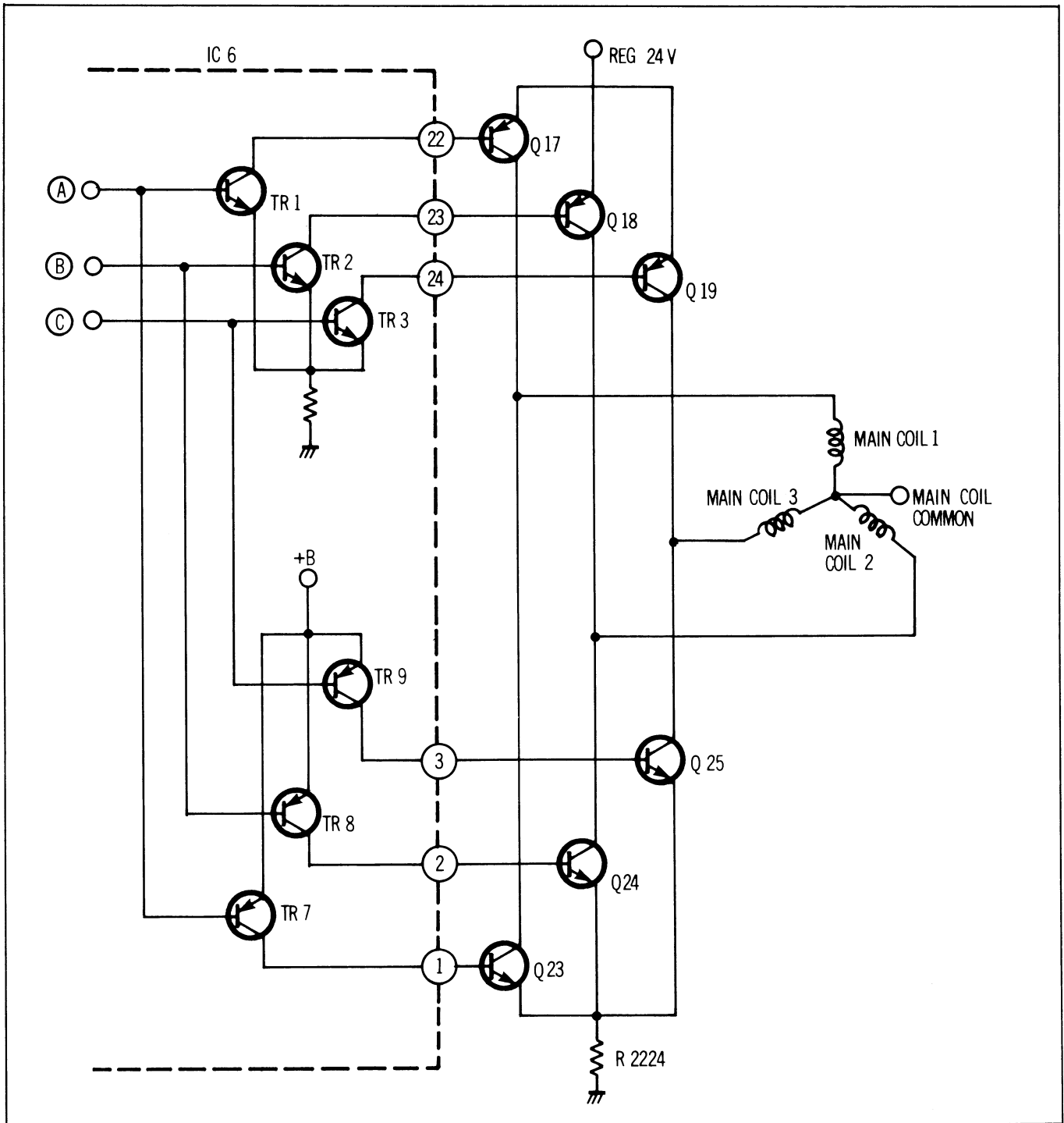


Figure 2-167

The transistor circuit actually drives the motor drive circuit. When the A, B or C waveforms are high, the NPN transistor will turn ON. When the waveforms are low, the PNP transistors will turn ON.

Referring to Fig.2-168, it can be seen that at any particular period, 4 transistors are off and 2 on, driving 2 main coils. The chart showing current flow is given in Figure2-169.

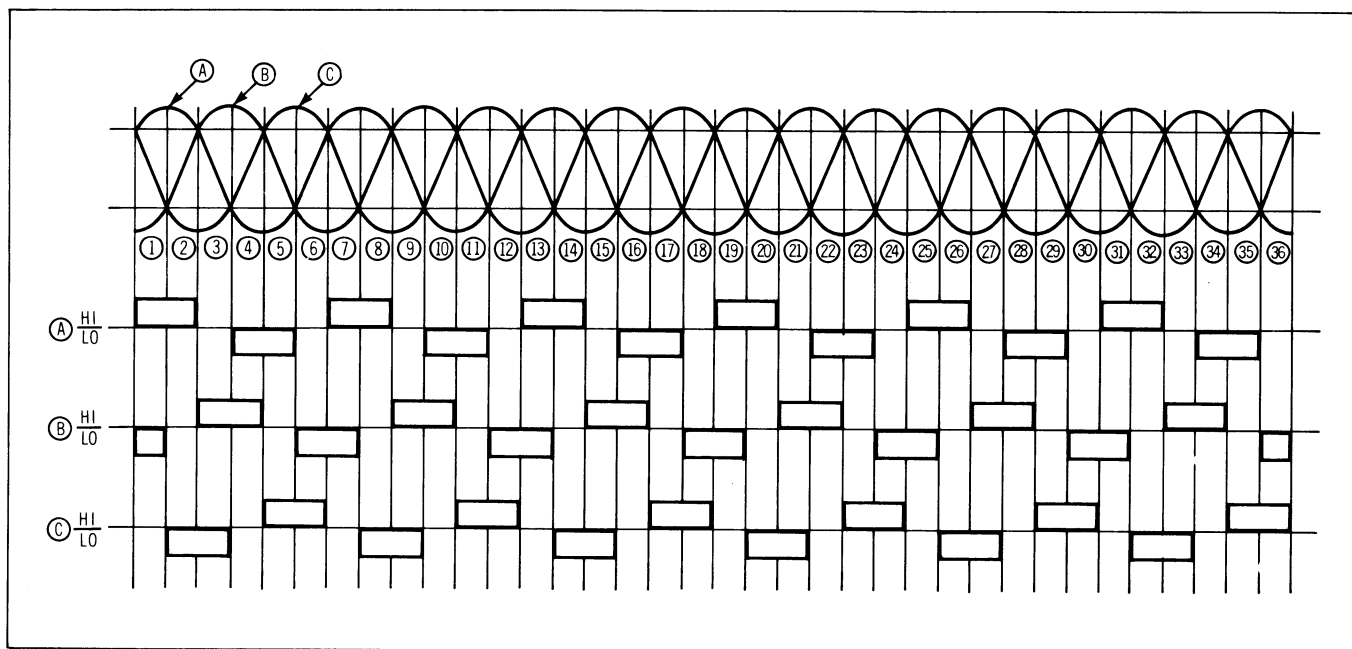


Figure 2-168

1	7	13	19	25	31	B+ → Q17 → M1 → M2 → Q24
2	8	14	20	26	32	B+ → Q17 → M1 → M3 → Q25
3	9	15	21	27	33	B+ → Q18 → M2 → M3 → Q25
4	10	16	22	28	34	B+ → Q18 → M2 → M1 → Q23
5	11	17	23	29	35	B+ → Q19 → M3 → M1 → Q23
6	12	18	24	30	36	B+ → Q19 → M3 → M2 → Q24

Figure 2-169

PERIOD						TR1 Q17	TR2 Q18	TR3 Q19	TR7 Q23	TR8 Q24	TR9 Q25
1	7	13	19	25	31	ON	OFF	OFF	OFF	ON	OFF
2	8	14	20	26	32	ON	OFF	OFF	OFF	OFF	ON
3	9	15	21	27	33	OFF	ON	OFF	OFF	OFF	ON
4	10	16	22	28	34	OFF	ON	OFF	ON	OFF	OFF
5	11	17	23	29	35	OFF	OFF	ON	ON	OFF	OFF
6	12	18	24	30	36	OFF	OFF	ON	OFF	ON	OFF

Figure 2-170

Overcurrent Protection

Two transistors are used for overcurrent protection of the Capstan and Cylinder motors and drive circuits. Q11 functions for the Cylinder and Q26 for the Capstan. The motor current is returned to ground via low ohmage resistors (R40 and R81). The voltage drop across these resistors should be less than 0.7 volt, and so the associated diodes (D5, D11) normally conduct, and the transistors (Q11, Q26) are off. Therefore, under normal conditions, IC pin 21 is high. If the voltage drop is excessive, the diode does not conduct but the base-emitter junction does, pin 21 goes low, and the internal IC protection circuit operates.

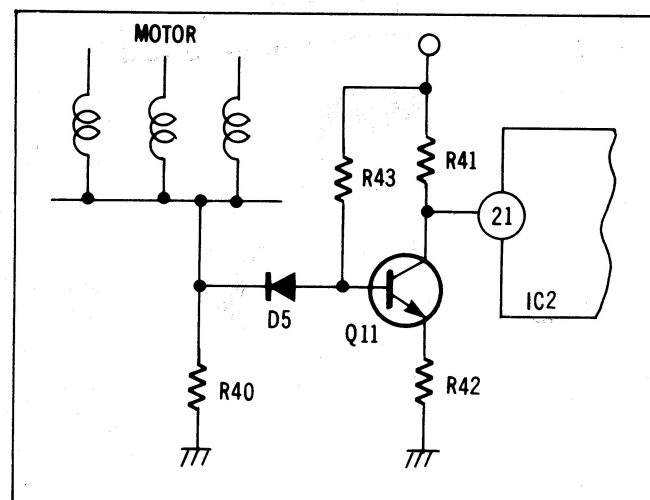


Figure 2-171

AU-700

Step Advance

The AU700 has provision for limited rotation of the capstan (one revolution) by a command from the AU-A70 Edit Controller.

This step command is only generated in the pause mode, and when it is possible the MPU generates a high output at P69-7, the Step Mode High. Each step command is a pulse which causes one "step" or 1 field advance, initiated by pushing the "+" button on the Edit Controller adjacent to the Pause button. One field step retard is possible by pushing the "-" button. The VTR is given a reverse command, and the Step drive circuit drives the capstan in the reverse direction.

Step Advance Circuit

When the step advance high signal (enable) is present, the normal 24 volt supply for the capstan motor drive IC is disabled (Q39-42), the capstan motor drive IC is disabled by defeat of the 65 kHz oscillator through D17, and 12 volt power is supplied to Step driver transistors.

The reset which holds the step counter is removed, when a step pulse appears through Q27, the divide by eight counter lets 8 cycles out from IC7-13, the divide by two counter.

This serves as input to the divide by three stage (IC8), in which two JK flip flops operate in tandem to produce three waveforms. These three are then divided by three flip flops to become three over lapping phases.

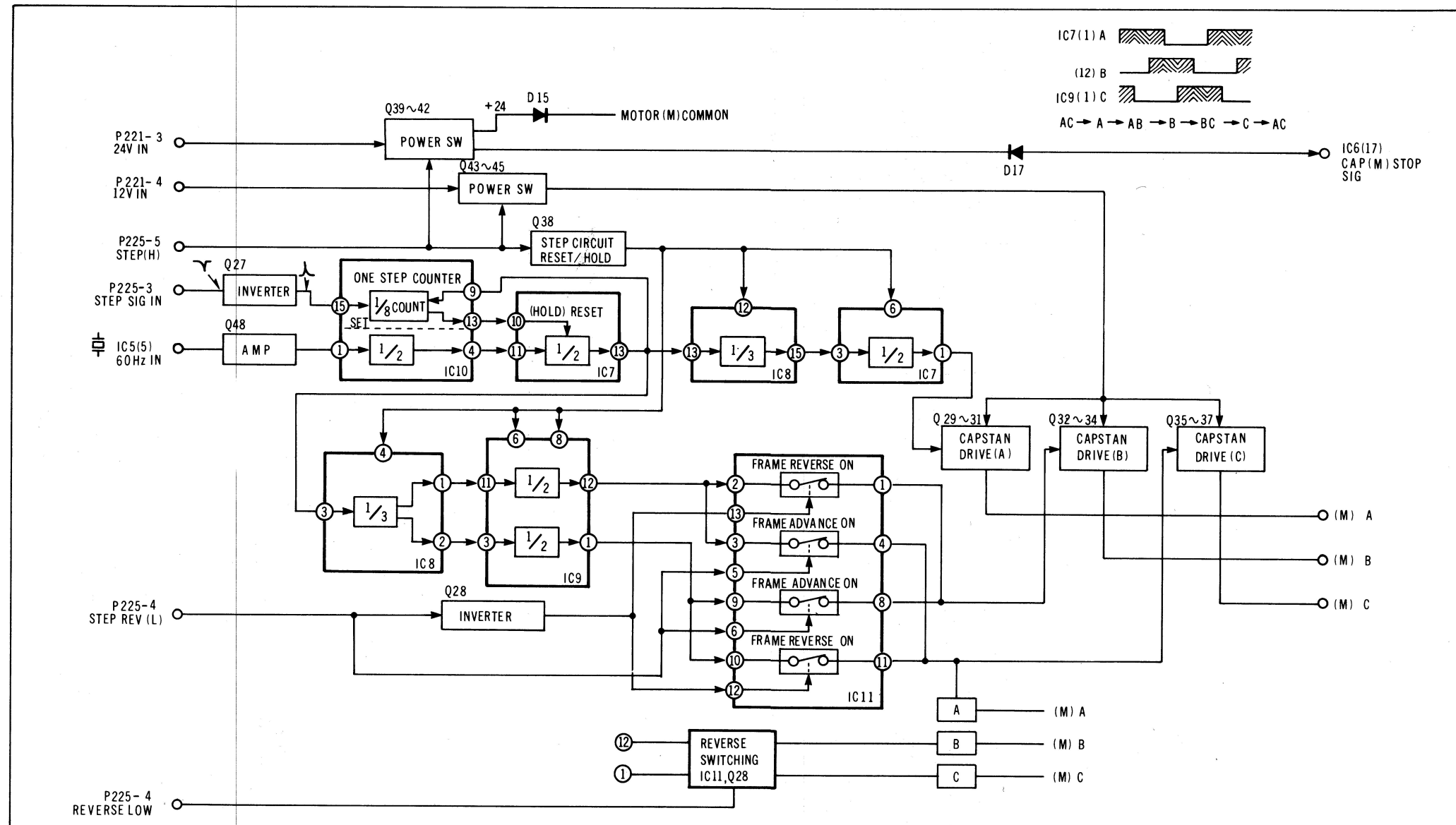


Figure 2-172

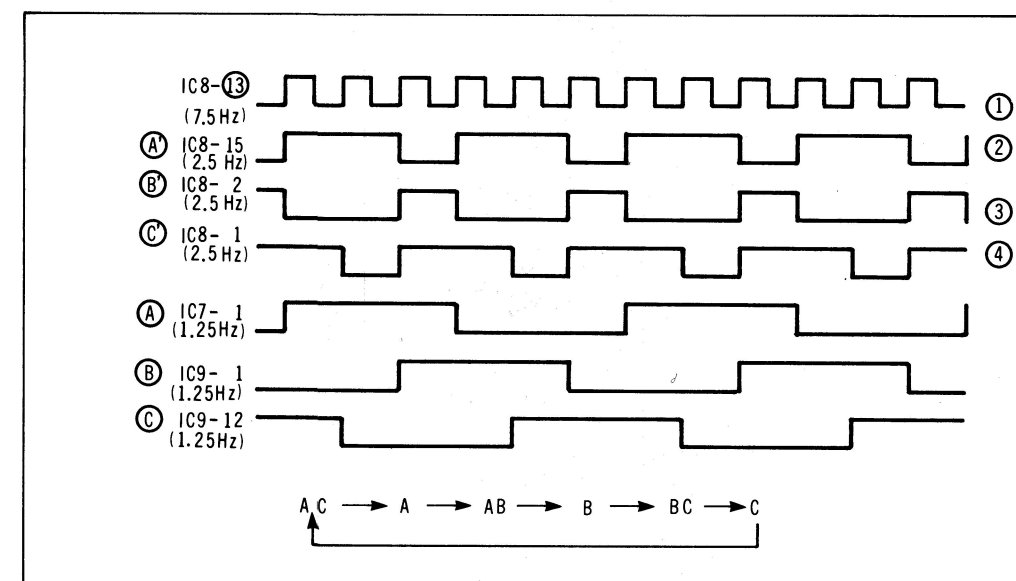


Figure 2-173

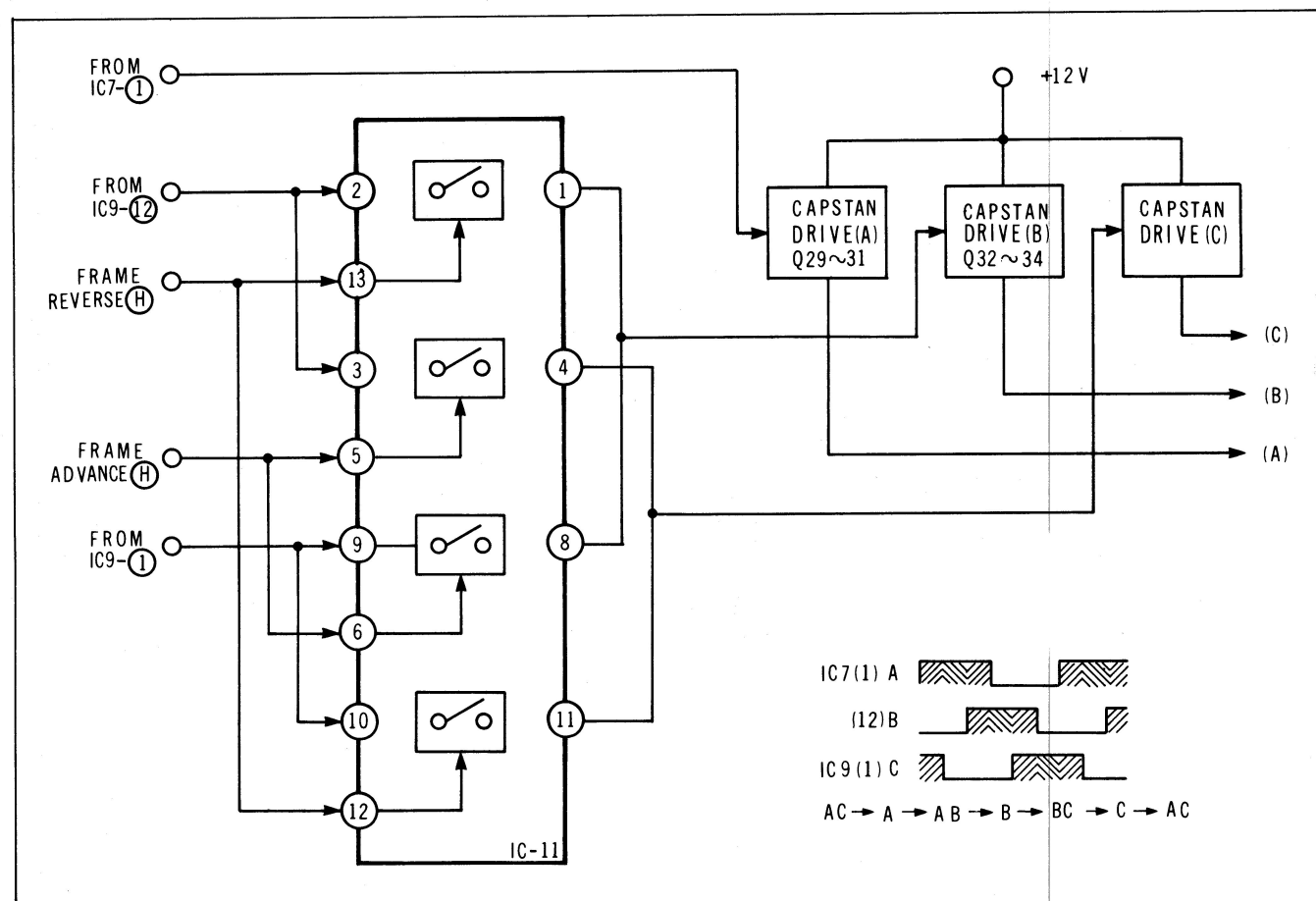


Figure 2-174

The overlapping output phases drive the step capstan Drive Circuits (separate from the ordinary drive circuits) to move the capstan. If rotation in the reverse direction is required, two of the phases are reversed by a switching network (IC11) driven by the reverse signal from System Control. The power switching circuits control both the 24 volt and 12 volt supply to these circuits. The step high (enable) signal at P255-(5) turns on Q45 through a slow turn on circuit D16, C57.

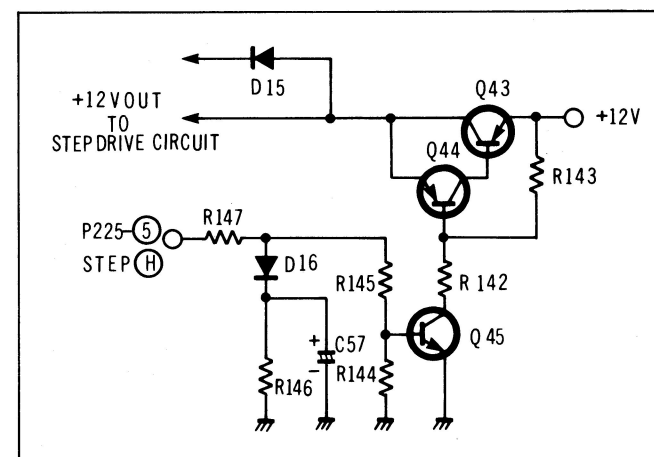


Figure 2-175

Q45 then turns on Q44, Q43, which supplies +12 volts to the step driver circuits, and to the capstan motor common, P219-6, through Diode D15. The 24 volt switching stage removes +14 from the normal capstan drive circuits, and shuts off the drive IC oscillator through D17. The step high signal is inverted by Q42, which allows Q41 to turn off and Q40, Q39 to turn off as well. Since Q42 is on, the low forward bias makes D17 conduct.

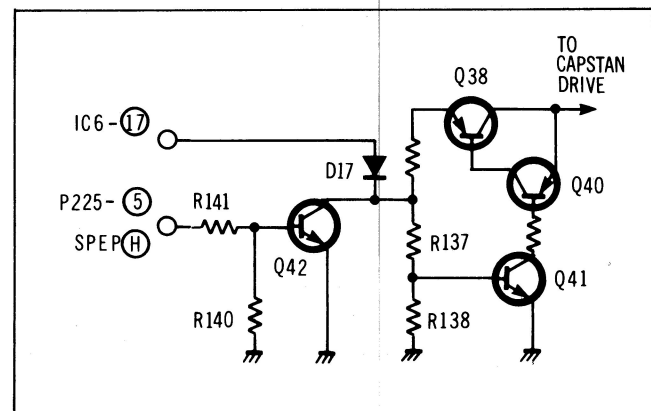


Figure 2-176

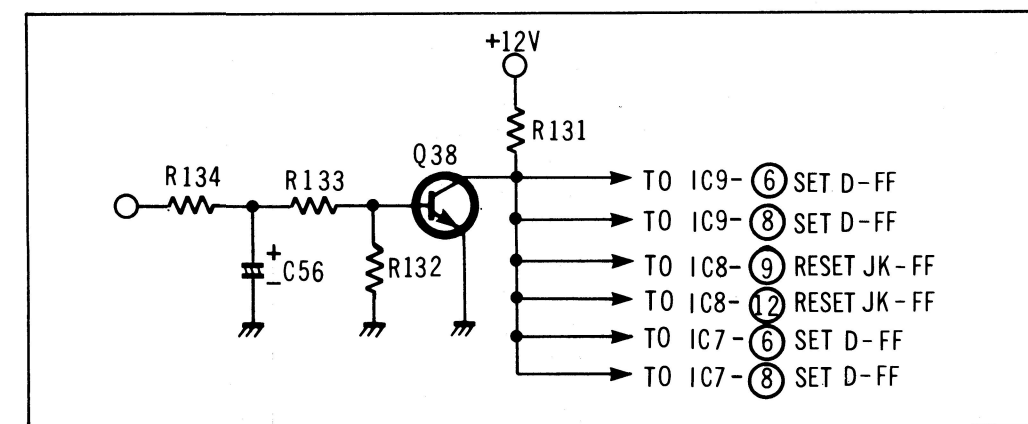


Figure 2-177

When the Step High signal appears, Q38 is turned on through a slow turn on network R134/C56. The output of Q38 is normally high, and holds the counter chain in reset. After C56 changes, Q38 is on and the reset (hold) is removed.

A 60 Hz signal, buffered by Q48 is supplied to IC10, where it is divided by four, and to IC7, when it is divided by two. The reset input of this ÷ 2 stage (IC7-10) is fed from an eight counter in IC10. When this counter reaches eight, the output on Pin 13 (IC10) stops the ÷ 2 (IC7). Therefore no pulses are fed to the remaining counter.

If a step signal appears at P225-3, it is differentiated by C51, and Q27 is turned off momentarily on the negative going edge. This resets the ÷ 8 counter, which then allows another eight pulses to go to the remaining count circuit.

The T or toggle inputs of the two JK flip flops comes from the held ÷ 2, IC7.

When it is allowed to count because (IC10) the ÷ 8 is reset, the output makes IC8 ÷ 3.

IC8 is a divide by 3 because the K inputs pins 5 and 11 are held high, and the J inputs are fed from the Q and $\bar{Q}$ output of the opposite flip flop. The third output is taken from Q of the second flip flop, to be out of phase. When these are divided in half by a D type flip flop (D is tied to $\bar{Q}$), the output is three symmetrical phases separated by 120° and overlapping.

These outputs turn on the motor coils, in sequence, through A (Q29, 30, 31) B (Q32, 33, 34) and C (Q35, 36, 37).

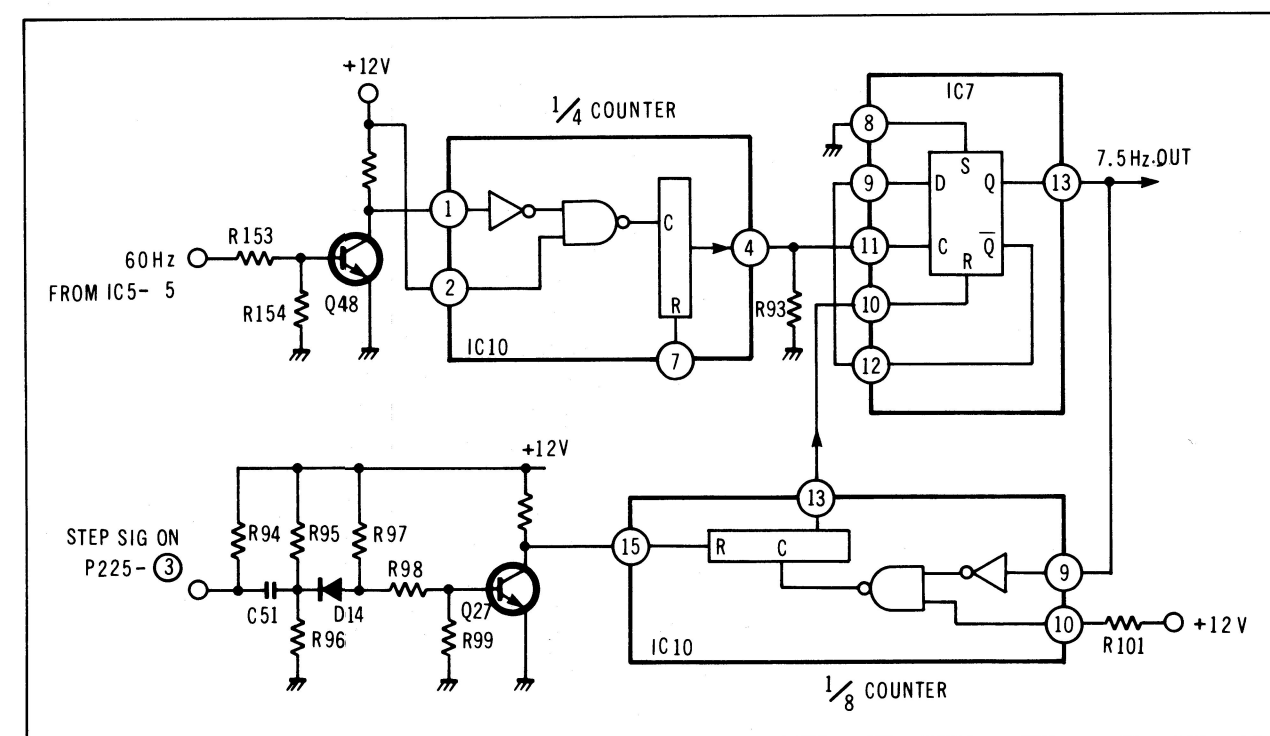


Figure 2-178

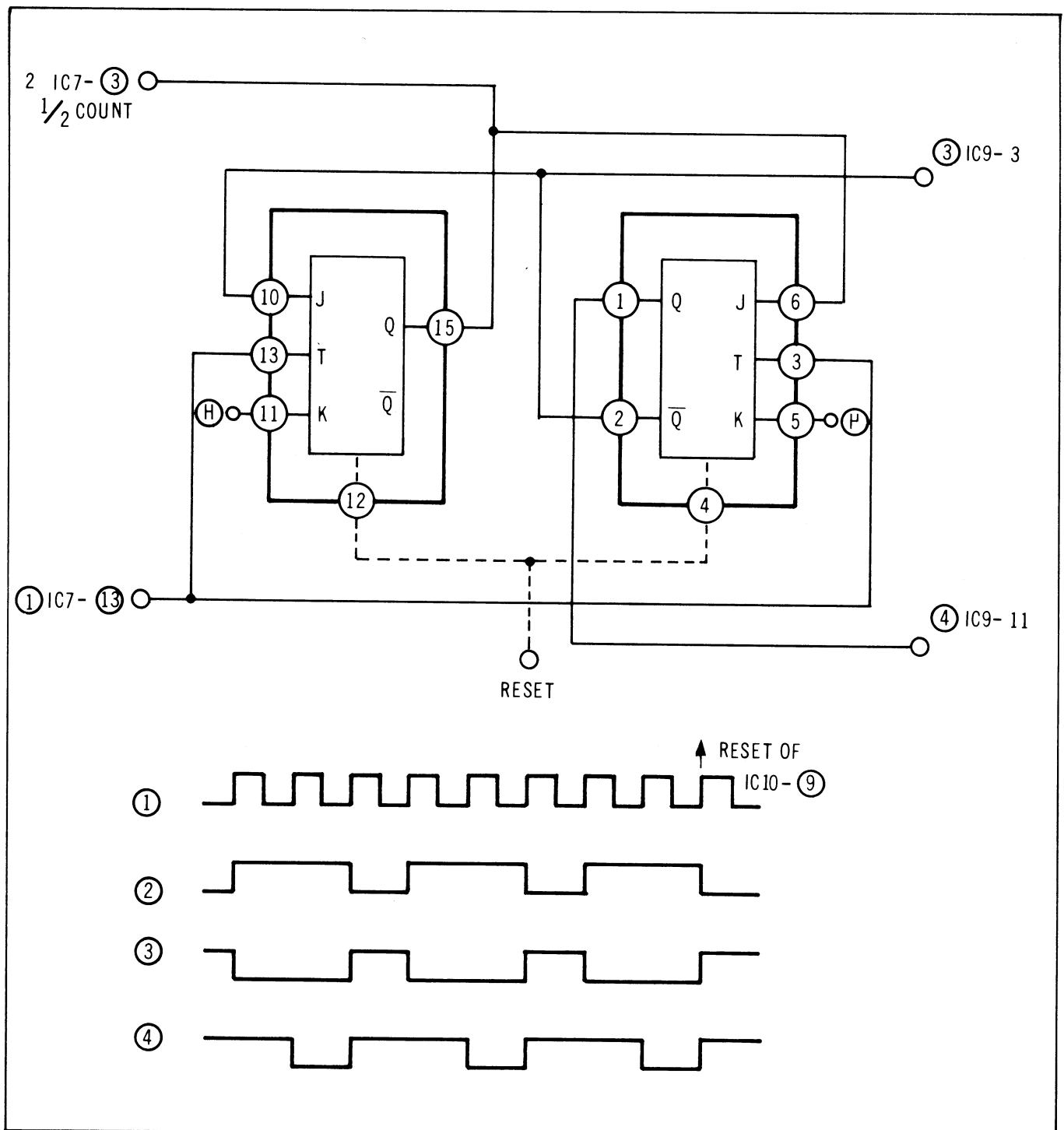


Figure 2-179

FRAME DETECTION CIRCUIT

When the playback vertical sync of a pre-recorded tape and the vertical sync of the program source to be edited are in phase, editing can be done without any vertical disturbance on the TV monitor. However, the horizontal sync may be disturbed at the edit point and cause horizontal flagging.

The probability of this disturbance occurring at the edit is 50/50 when the video signals are 2:1 interlace.

This disturbance is caused by the mis-alignment of odd and even fields which differ by $1/2$ a horizontal line.

NTSC Synchronization

In NTSC video, the color subcarrier, horizontal sync and vertical sync are locked in a precise phase relationship. To achieve interlace, the 525 line Frame is divided into two 262.5 line fields, and the vertical sync interval is divided into one half H (horizontal line timing) segments. These serve to keep the horizontal sweep of the monitor in continuous synchronization. The two fields which make up a frame are called, variously, field one and field two, or even and odd. For this discussion, field one or the even field, is that field which begins with one full H line, and field two, or the odd field, is that field which begins with one half H line. In order to have stable horizontal sweep, the fields must come in sequence, and edits should only be performed between frames.

If an edit is performed joining two like fields (two odd or two even fields), there will be a half H error in Horizontal sync, and the monitor will exhibit flagging until H lock is reestablished.

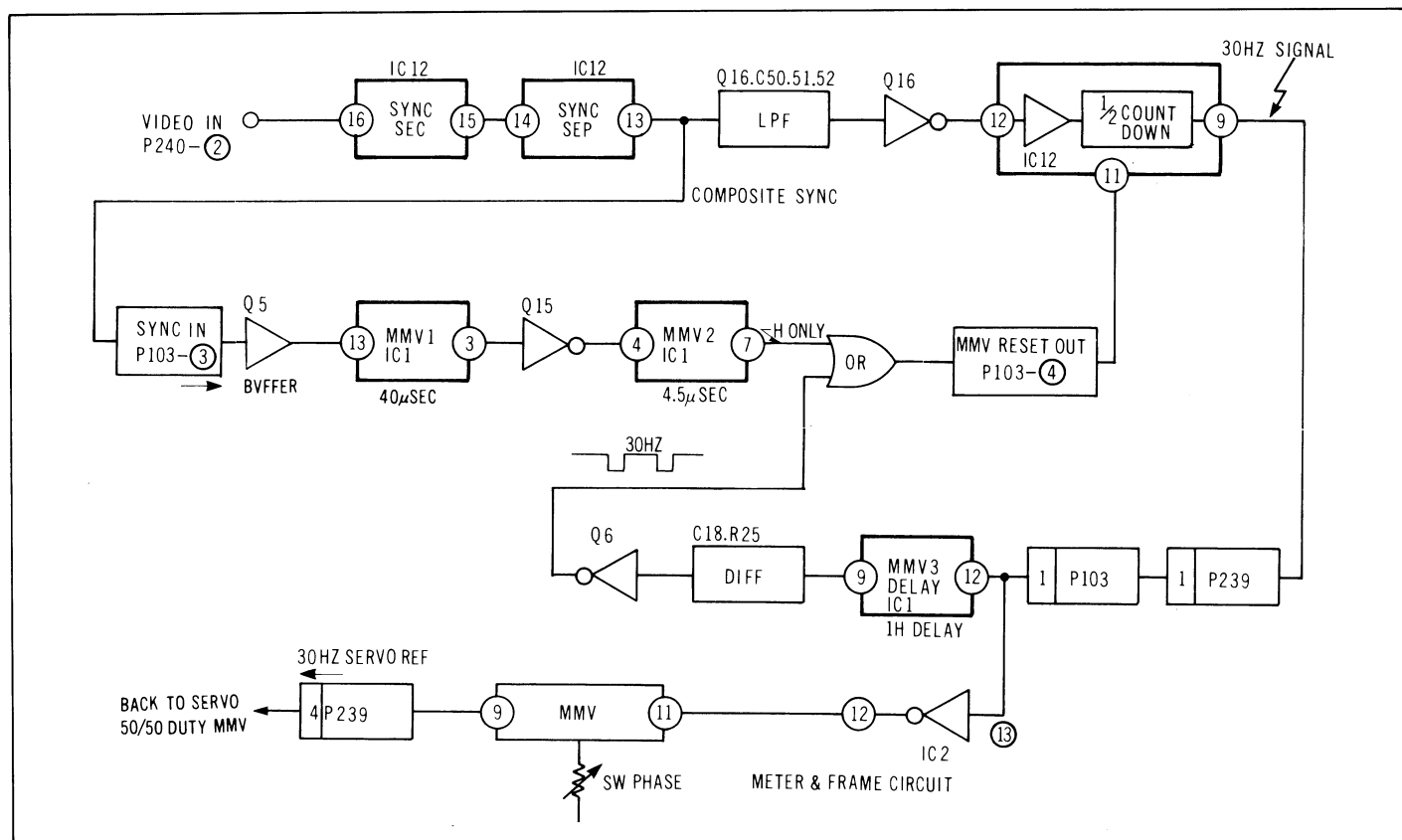


Figure 2-180

[If a direct color recording process is used, further consideration must be paid to color subcarrier phase in relationship to the vertical interval, and an edit may be performed only at every other frame, or every fourth field, but this is not applicable for this unit.]

To prevent a horizontal disturbance at the edit points, it is necessary to detect the difference between fields, called "frame detection", and then to force the servo to synchronize the vertical intervals of the two video signals.

When the frame detection switch (S6305) is on, the edit point always begins during the vertical sync signal at the start of the field ("frame editing").

Frame editing is accomplished by making the servo circuits lock to the vertical sync of the 1st or even field in both record and playback.

If the servo locks always to a particular field (in this case the first or even, which is the start of a new frame of picture) then one video head will always lay down the even field, and the other one the odd field. These heads will always be synchronized with the head switching signal, which can then be used to start or stop the edit record process.

This means for proper frame editing to take place, the previously recorded material must have been recorded with the frame detector switch ON, so the heads and servo have the proper relationship to vertical sync.

Meter and Frame Circuit Description

The object of the frame detector is to make the servo lock to the vertical sync of the 1st, or even field. In the Servo system the video signal supplied from terminal (2) of connector P240 (Servo Control Circuit, VEP02100) is sent to pin (16) of IC12. As was described in the Servo description the video signal is amplified and goes through C40 to a sync separator.

The separated sync signal at pin (13) contains composite (horizontal and vertical) sync, shown in Figure 2-182(2).

The composite sync is sent through a low pass filter (V. Sync Separator) consisting of C50, 51 and C52. The low pass filter eliminates the higher frequency horizontal sync and passes only the vertical sync, shown in Figure 2-182-(3). The separated vertical sync signal is passed by Amplifier Q16 and inverter Q15 to IC12 (12). At pin (12) the vertical sync signal triggers a 1/2 count down monostable multivibrator. This results in a 30 Hz sync signal offset from the leading edge of V sync by approximately 1.5 H, shown in Figure 2-182 (4), at pin (9) of IC12.

This signal is fed to the monostable multivibrator (MMV) 3 IC1 (12) and (9) through P239-(1) and P103-(1), and delayed 1H as shown in Figure 2-182 (8). This MMV3 is triggered by the positive going edge of the 1/2 count down signal, Figure 2-182-(4). The delayed signal is differentiated by C18 and R25, shown in Figure 2-182 (9). This is inverted by Q6 to form the pulse shown in Figure 2-182(10). At the same time, the composite sync signal from pin (13) of IC12 is also buffered by Q5, through connectors P239-(2) and P103-(3), and applied to MMV1, IC1 pins (13) and (3). This M.M.V.1 is triggered by the composite sync signal as shown in Figure 2-182 (2). Because the duration is 40μs, the equalizing pulses are eliminated by this MMV, as shown in Figure 2-182 (5), and the output is inverted by Q15, as shown in Figure 2-182 (6). This signal triggers a second MMV, IC1-(4), (7), with a duration of 4.5μs, which makes a horizontal sync output without equalizing (1/2H) pulses.

The continuous H rate pulses, shown in Figure 2-182 (7) and the delayed 1/2 MMV single pulse at Q6 Figure 2-182 (10) are resistively coupled at a coincidence detector, Q7. Since both waveforms are normally positive, either will hold Q7 on. However, if both are negative at the same moment, Q7 turns off, and the positive pulse is double inverted by Q8 and Q9 as shown in Figure 2-182 (13).

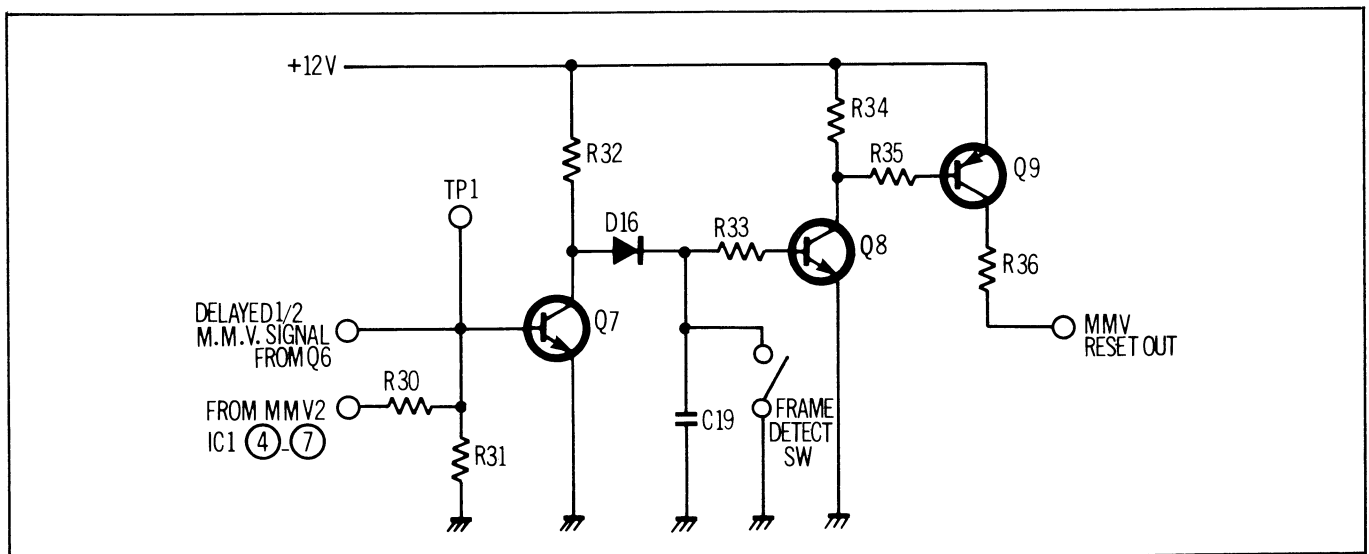


Figure 2-181

If the Servo Locks to the vertical sync signal of an even field, the waveform shown in Figure 2-182 (11) is obtained at TP1, the vertical sync phase is proper, there will be no horizontal disturbance at the edit point, and no reset pulse is made.

However, if the Servo Locks to the vertical sync signal of odd field, coincidence occurs, and a negative going pulse occurs at TP1, shown in Figure 2-182 (12). This is inverted and used to reset the 1/2 count down M.M.V in IC12 on the Servo Circuit. This reset pulse will cause the M.M.V. to shift, thus locking to the vertical sync from the even field.

(See Figure 2-184)

If the frame detection is defeated by switch S6305, this reset pulse is grounded, and the M.M.V. will not be reset.

When the frame detector is on, the servo locks to the even field, which is the desired condition. The frame detector should be off if non RS-170 or random interlace video signals are to be recorded. They may cause the unit change its servo lock in mid-recording.

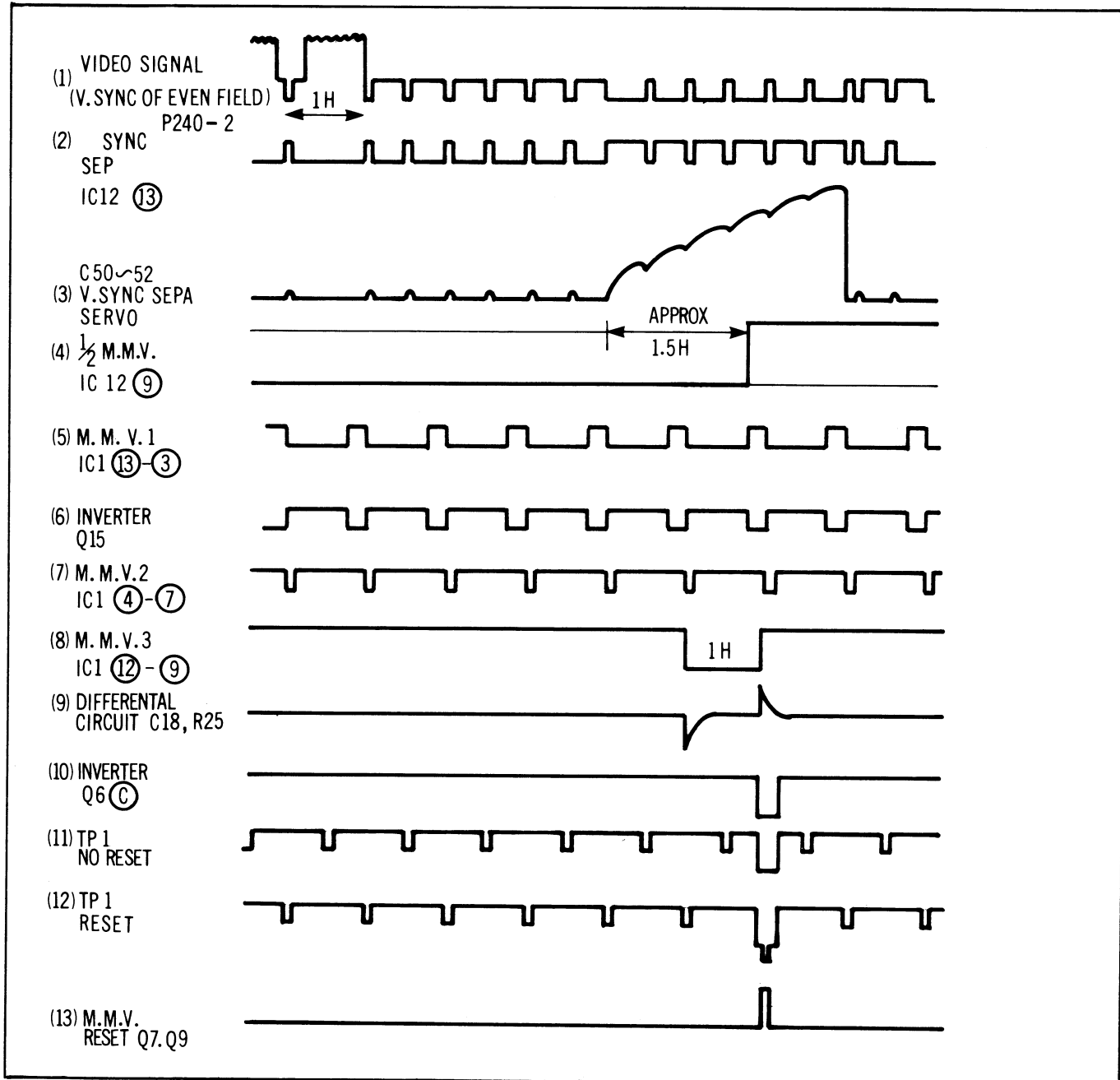


Figure 2-182

H Phase Adjustment Circuit

The system described above will allow the proper vertical interval to be chosen by the servo system, and thus achieve vertical rate lock. However, the edit may still cause an H sync disturbance due to mis-alignment of the H sync between original tape and new video. The H phase adjustment circuit adds a small adjustable delay in the servo reference path, and provides a sensing loop as well as a manual control and indicator lamp. Beginning with the principle that the position of the head cylinder is servo locked to incoming Vertical sync, and that the instantaneous position of the head cylinder controls the playback video H phase (in time), it is possible to adjust the servo reference to alter playback H phase.

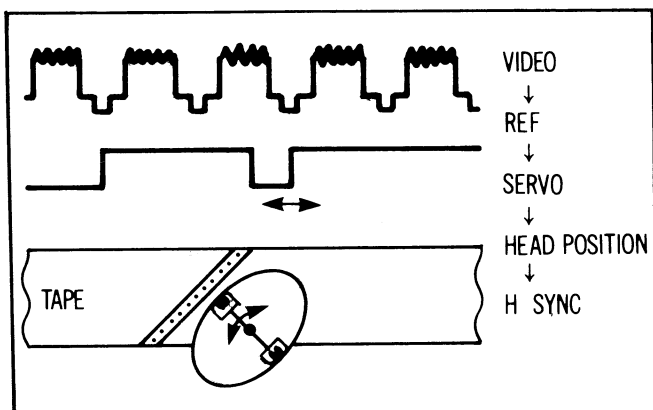


Figure 2-183

This circuit adjusts the H phase of the playback video signal to match that of the input video for editing. To achieve this, the 1/2 M.M.V. signal from the servo circuit is delayed by M.M.V. 2, approximately 110 μ sec to 170 μ sec. This allows H phase to be shifted back and forth, as needed.

The 1/2 M.M.V. signal from P103-(1) is differentiated by C20, Figure 2-185 (2), and is inverted by IC2-(13) and (12), Figure 2-185 (3). Thus the negative pulse at IC2-(12) triggers M.M.V.2, whose duration is determined by C27, R41, R42 and the DC level from IC3-(8), Figure 2-185 (4). This DC level is made by sampling a trapezoid at Q10.

The head switching pulse, which indicates the relative position of the head drum or cylinder is made into a trapezoid by IC2, D18 and C25, with the ramp angle set by R6315, H phase, and R52. See Figure 2-185 (5), (6).

This ramp or trapezoid is buffered by IC3-(2,3,4) operating as an emitter follower. The differentiated servo reference, made from incoming V sync by the 1/2 M.M.V., is inverted by IC2-(10,11) to drive Q10, the sample switch. The D.C. level produced is held in C24 and is passed by D20 to IC3-(6,7,8), an emitter follower to drive M.M.V.2(IC9) as described above. See Figure 2-185 (6), (7).

Therefore, any change in phase between incoming video sync (which makes the 1/2 M.M.V. 30 Hz, and in turn the sample pulse) and the head position (which controls playback video H phase) will cause a change in D.C. voltage. This change will alter the delay of IC4 M.M.V.2, which is in the servo reference path. The variable edge of this M.M.V. output is the trigger for the 50/50 duty cycle M.M.V. in the servo, IC12 pin (5). Refer to Figure 2-187, page 144.

The output of the sample and hold, Q10, through IC3, is DC and is added to the SW Phase adjustment R42.

R42 adjusts the pulse width at TP4, Figure 2-187 for 140 μ seconds during recording R52 adjusts pulse width at TP4 for 140 μ seconds during playback. Q11 and R54-R57 network inhibits H phase Adjustment during record.

During recording, a high appears at the connector P104-(5) to turn Q11 on and DC level at IC3-(6) becomes 6V (divided by R53 and R57), so the duration of M.M.V.2 does not change during Record or Assembly Mode.

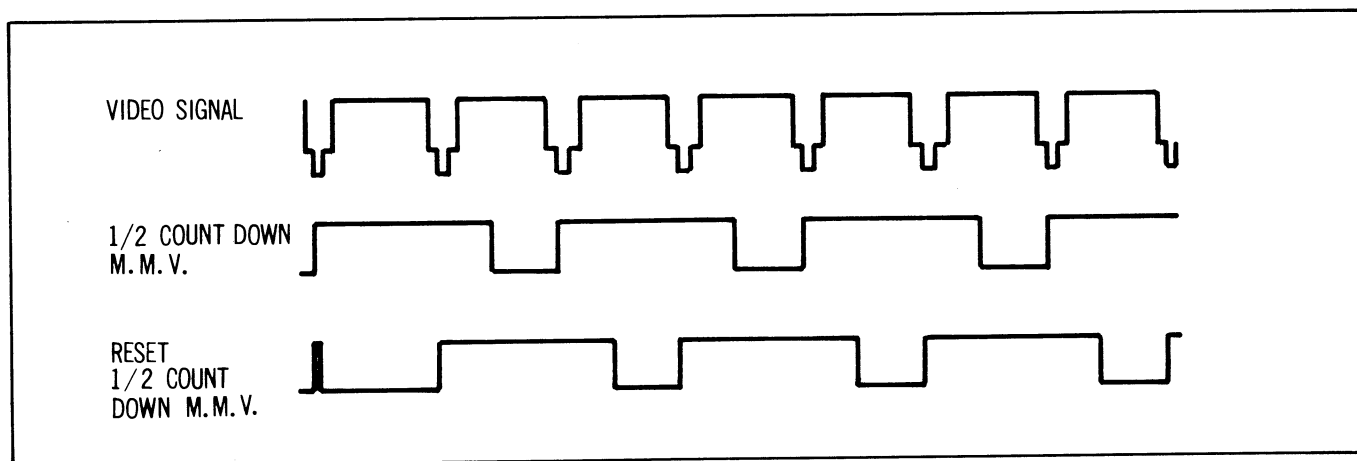


Figure 2-184

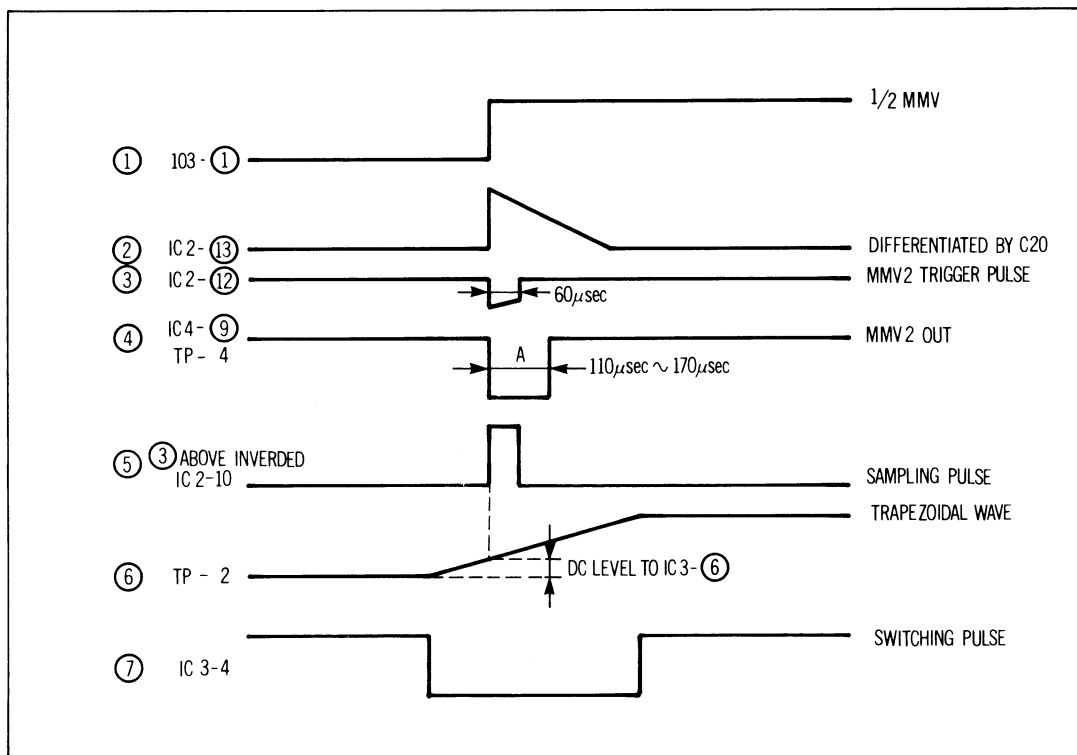


Figure 2-185

Frame Lamp Drive Circuit

This circuit drives the frame lamp, PL6308, which lights when the H phase difference between input video signal and playback video signal is minimal.

The frame lamp should be on before editing is performed. If the frame lamp is off, H phase, R6315, ought to be adjusted. See Figure 2-187.

Playback sync (H only) from P104-3 is supplied to M.M.V.1, pin 5 of IC4. The Q M.M.V. signal is supplied to

a trapezoid waveform circuit, which consists C31 and IC5-(3,4,2).

This trapezoidal waveform is sampled by H sync signal from incoming video signal. The output of the sample and hold, Q12, is compared with the reference voltage determined by R65/R83, by the comparator IC5-(6,7,8).

If the reference is not exceeded, a high at the output lights the frame lamp through Q13 and Q14. See Figure 2-186.

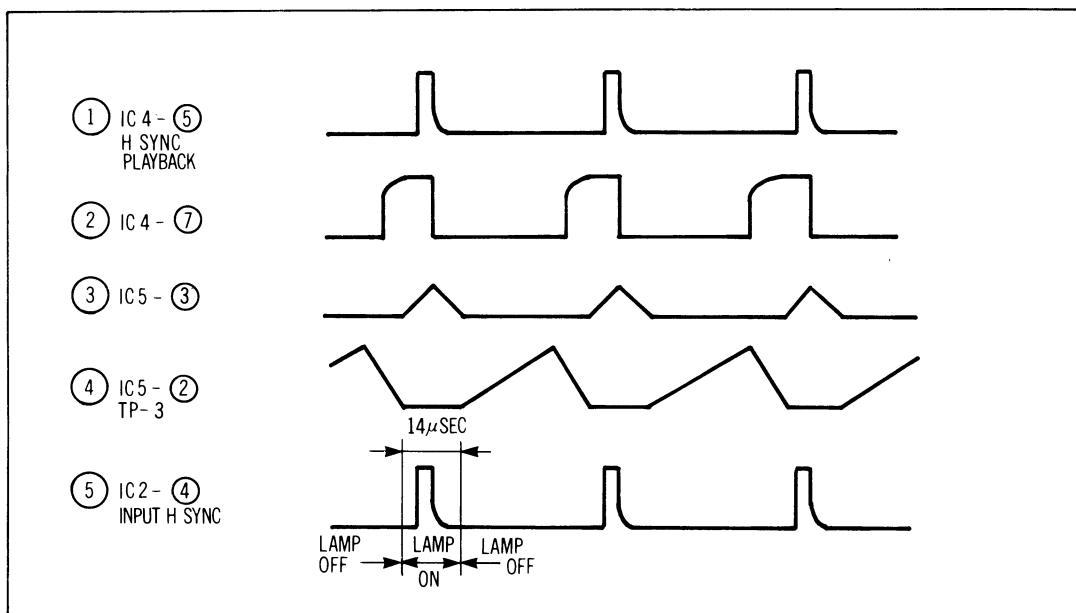


Figure 2-186

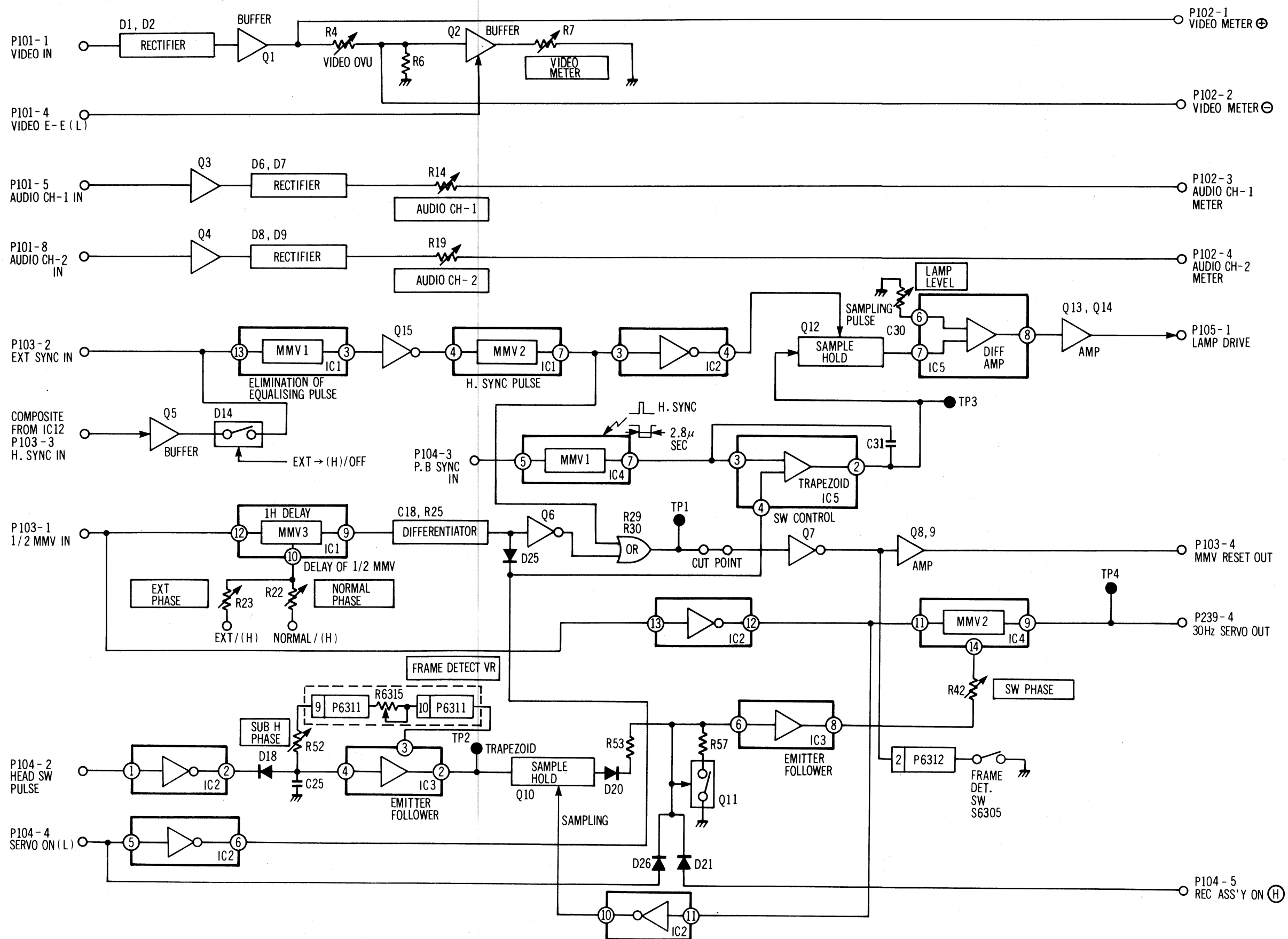


Figure 2-187

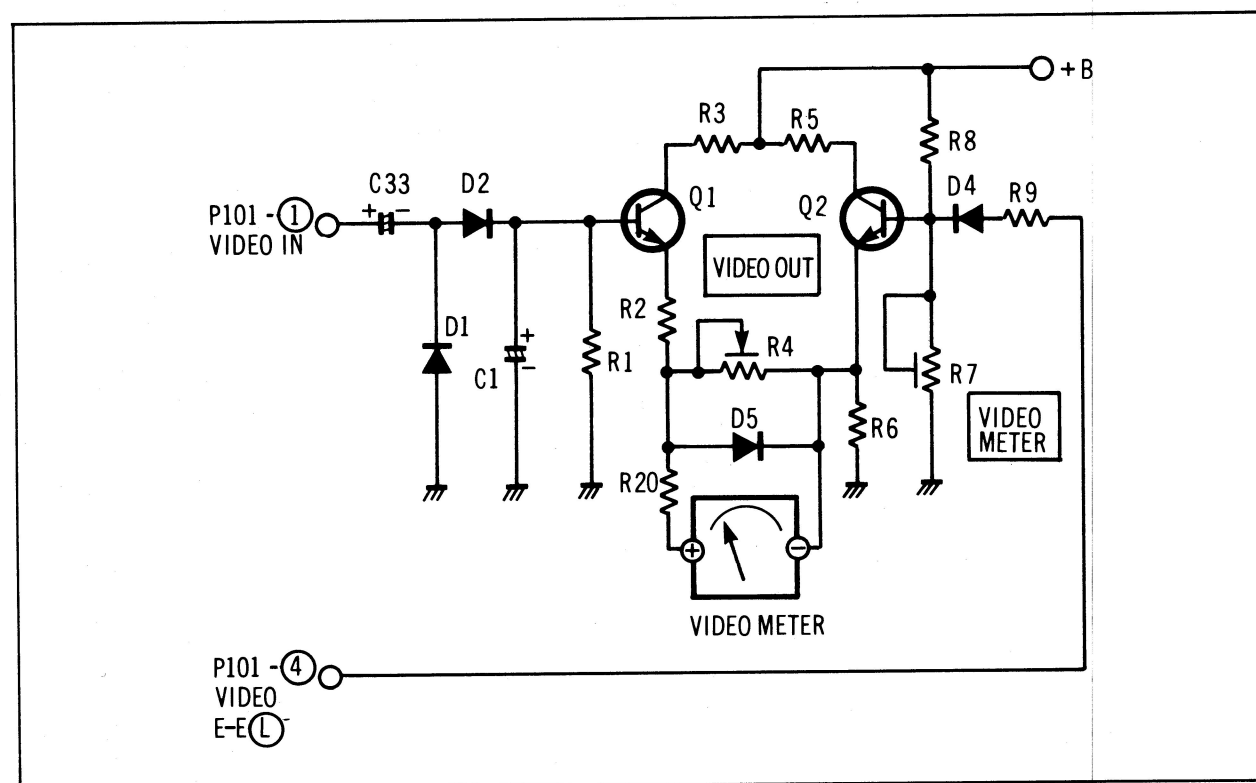


Figure 2-188

Meter Circuit

Video Meter

The video signal is applied to a voltage doubler, D1, D2, C1 and R1. This DC voltage is then applied to the base of Q1, and appears across the emitter load circuit, as shown in Fig. 2-188.

If the unit is not in the Video E-E mode, a high level signal is applied to Q2 through R9 and D4.

This high level signal then appears across R6 at the emitter of Q2, keeping Q1 reversed biased (off), and there is no meter deflection.

In the video E-E mode, no high signal is applied (R9 and D4) and the only bias Q2 has is from the voltage divider R8 and R7. The emitter voltage of Q2 is adjusted by R7, which sets the minimum level of the meter in the manual (not AGC) mode.

R4 adjusts the 0 dB point of the meter.

Audio Meter

This description is for Audio CH1, but also applies to the identical CH2 circuit (See Figure 2-189).

The Audio signal is applied to the buffer Q3. The output at its emitter is rectified and filtered. The DC level is adjusted by R14, and is sent to the audio meter in the audio E-E mode. D22 is a Zener to protect the meter.

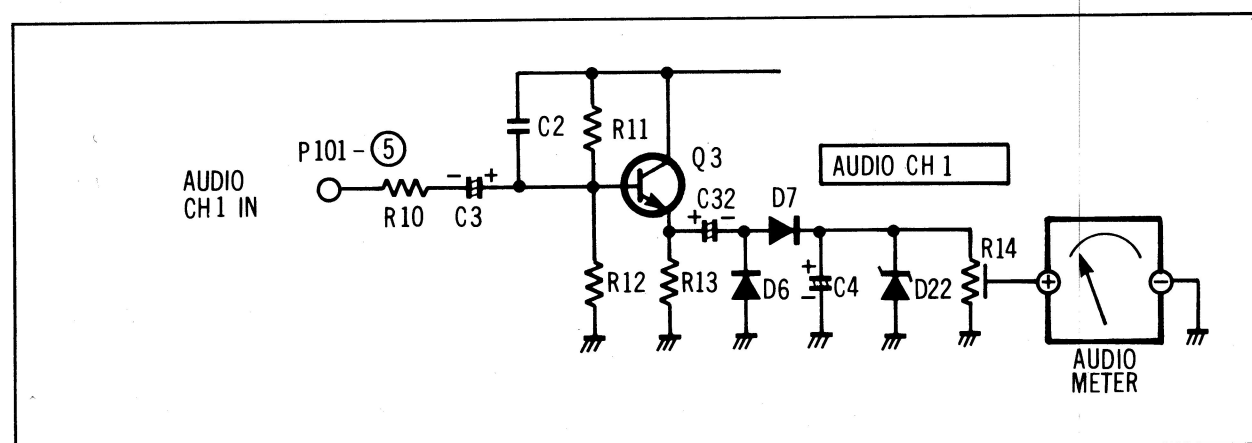


Figure 2-189

Reel Servo Circuit

General Description

The reel servo circuit drives the reel motor, which, through a pair of idlers, drives the reel turntables for tape movement in fast forward and rewind, and for tape tension in play or record.

Since the diameter of the tape pack, and hence the effective reel diameter, changes greatly (2.5 times) from beginning to end of tape, some form of torque control must be provided to set proper takeup tension. Therefore, a higher voltage is supplied to the reel motor at the beginning of a cassette than at the end. Further, since the tape capstan drive has five speeds both forward and reverse, suitable provision must be made for tape takeup.

The reel motor generates an F.G. signal which is converted to a square wave by a schmitt trigger. This square wave then is differentiated as shown in Figure 2-190 ③. This pulse serves as the reset for a trapezoid ramp generator circuit. The input which forms the sawtooth signal is a DC voltage is formed from the Capstan FG signal.

Since the capstan FG signal varies depending upon the playback speed, such as X5 (3,750 Hz), X2 (1,500 Hz), X1 (750 Hz), X1/5 (150 Hz) and X1/20 (37.5 Hz), rise time voltage of the sawtooth also varies. The sawtooth and reel motor FG pulse, which quenches the ramp, are sent to a peak hold circuit which stores the peak value of the sawtooth waveform. The output of the peak hold circuit is a DC level which serves to drive the Reel motor at a particular speed or torque.

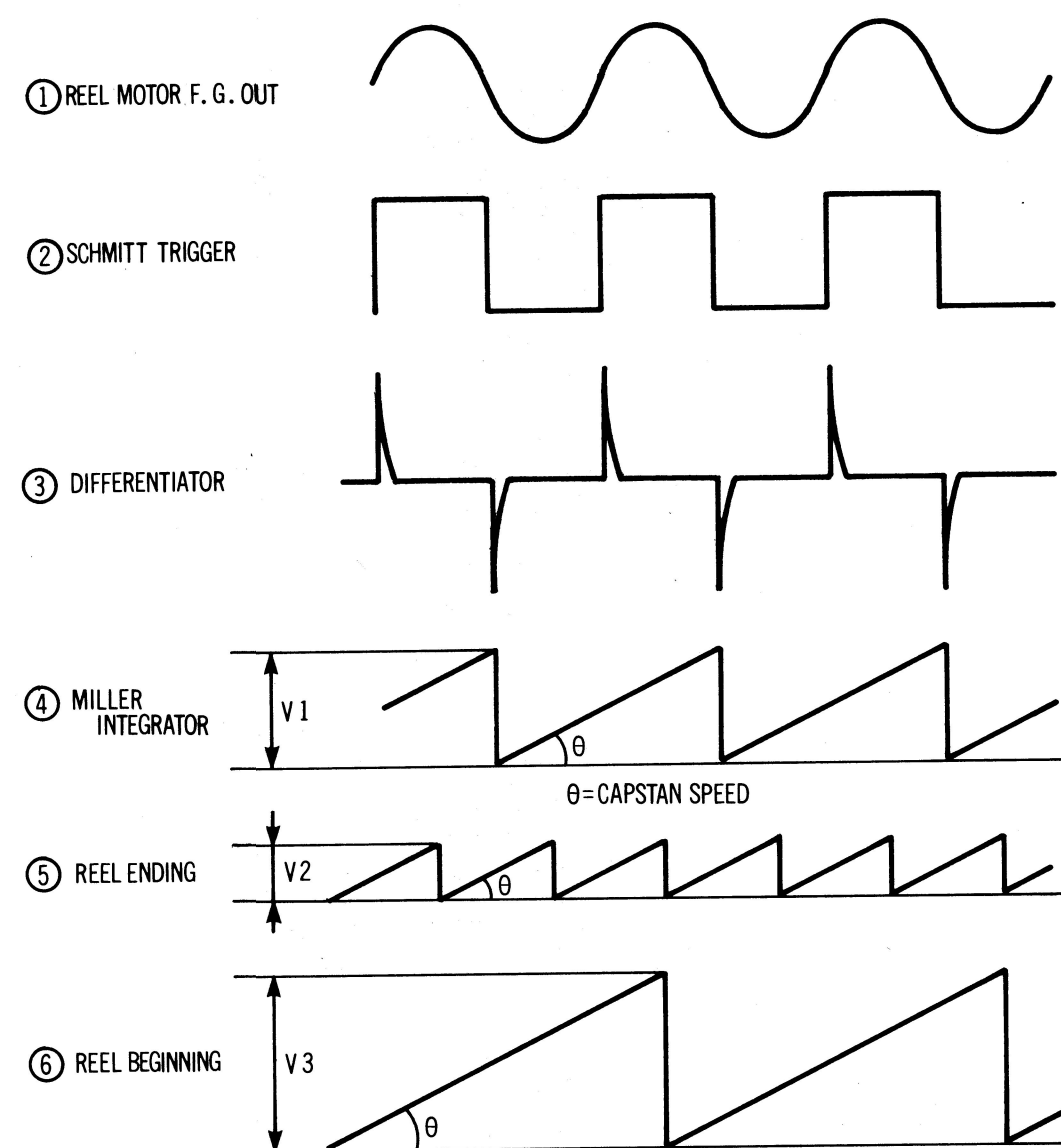


Figure 2-190

Detailed Description

Sawtooth Reset Pulse Generator

The reel motor FG signal from pin (4) of connector P251 is applied to the base of Q2. The FG signal is amplified by Q2 and Q3 as shown in Figure 2-192.

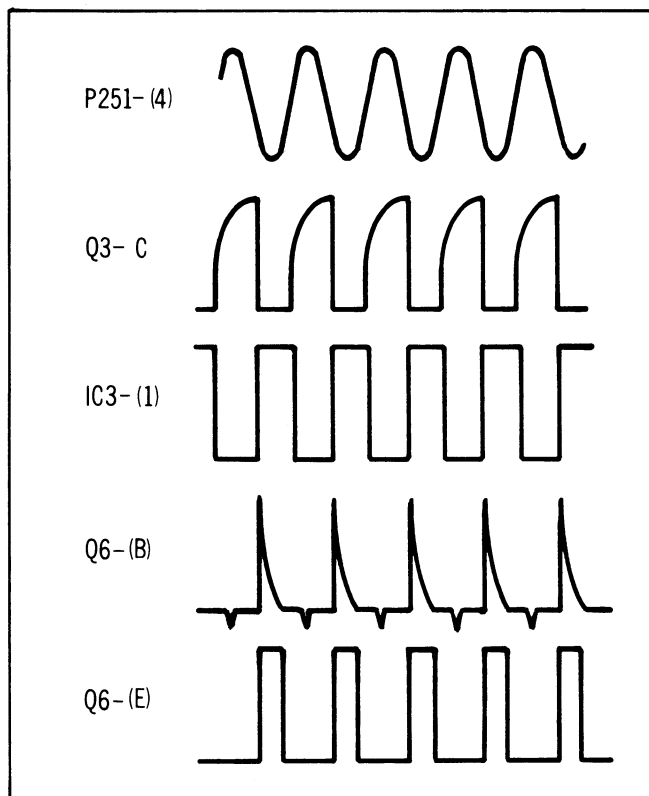


Figure 2-191

The amplified signal then goes into pin (2) of IC3 which functions as a schmitt trigger circuit, shaping the output to a square wave. This is differentiated by C9 and negative going pulses are shunted to ground by diode D1. The waveforms of this process are shown in Figure 2-191. Only the positive pulse is used for the sawtooth generator circuit.

Mode Select Circuit

This circuit selects the proper differentiator network for the speed modes which are fast (X5, X2, X1), and slow X1/5 and X1/20). The capstan FG signal will be differentiated by C1/R12 for slow speed and by C2/R11 for fast speeds. Switching is controlled by IC1, which receives a Slow High signal from P251-2 (See Figure 2-193).

Normal Speed (X1) mode

The capstan FG signal (750 Hz) from pin (1) of connector P251 is amplified by Q1 and then goes to pin (13) of IC1, after differentiating by C1 and R12, and to pin (6) of IC1 after differentiating by C2 and R11. The other inputs of IC1 get a switch signal from pin (2) of connector P251 (Slow H).

Pin 5 is High during slow, and pin 12 High during normal due to an inverting gate, IC1-(3). Since IC1-(5) is always a low level during X1 mode, a positive pulse appears at IC1-(4) when a negative pulse is supplied from differentiator C2 and R11. Then IC1-(10) provides negative pulse since IC1-(9) always maintains a low level because of the inverter IC1-(3) output to IC1-(12) which is high during X1 mode. The timing chart is shown in Figure 2-196.

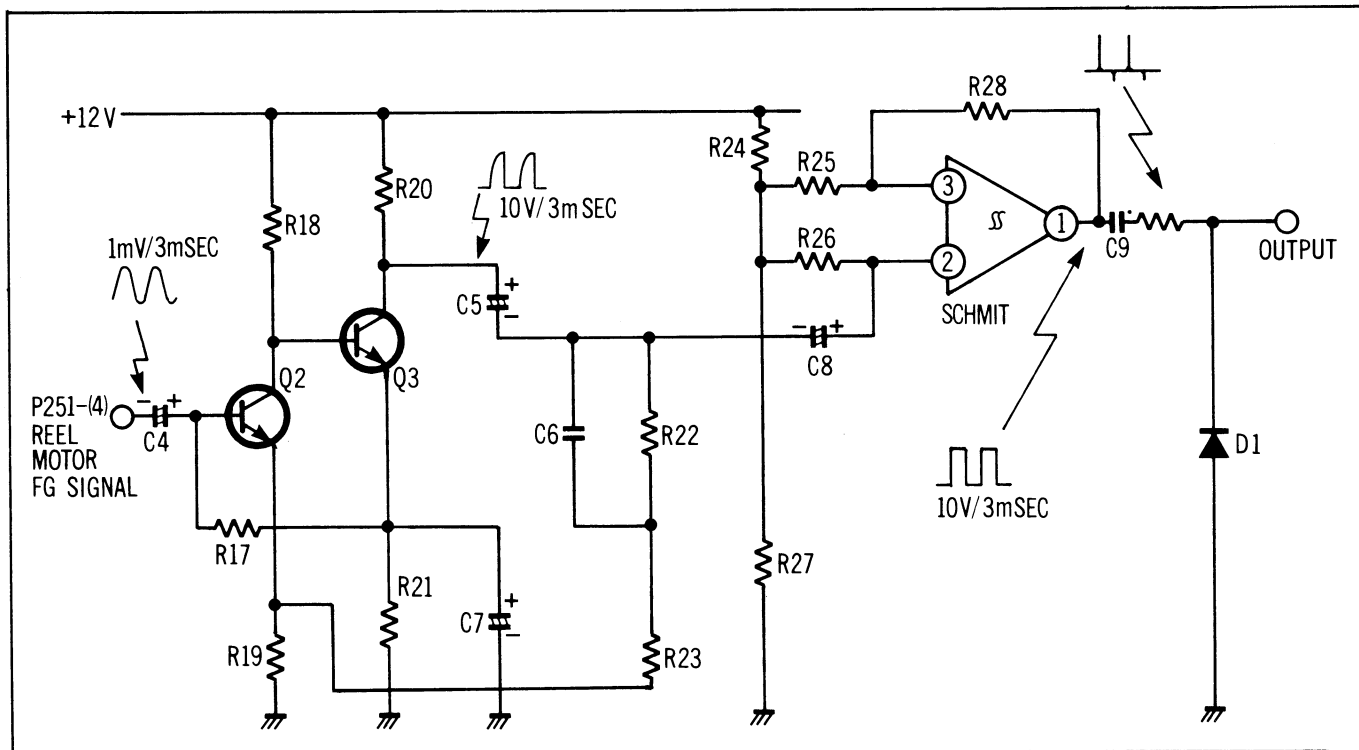


Figure 2-192

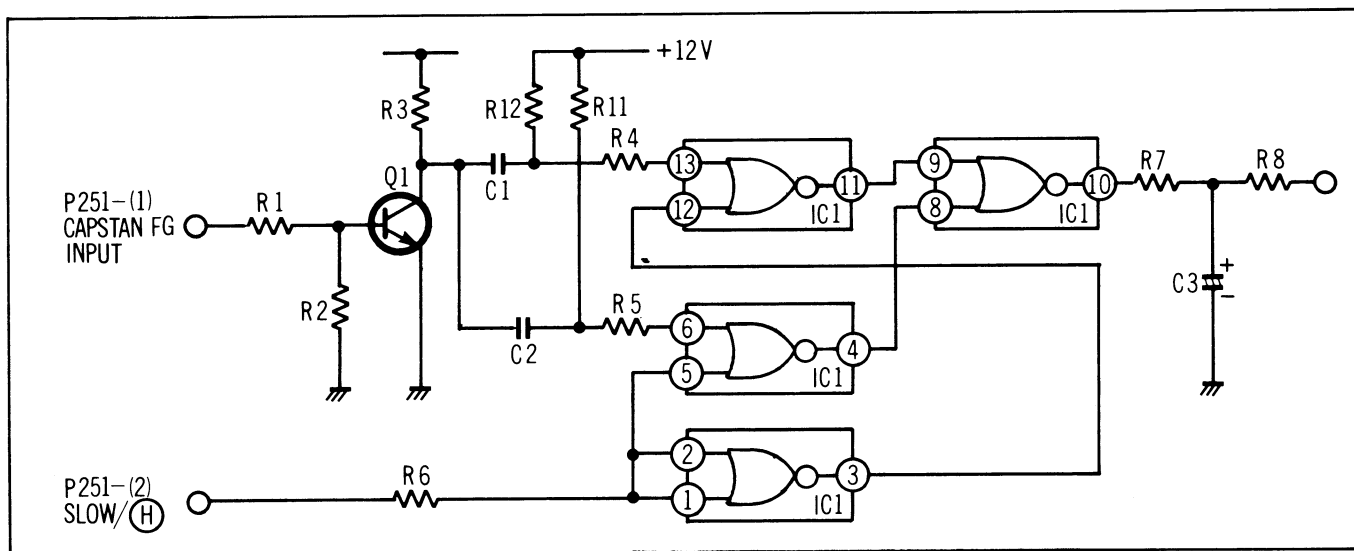


Figure 2-193

These negative pulses at IC1-(10) are converted to a DC voltage by the low pass filter, R7 and C3. In this way, a different DC voltage is present for each mode: X5, X2, X1, X1/5 and X1/20, as shown below;

Table of Voltage

x5	8.7V	x1/5	8.7 ~ 9.1
x2	9.4V	x1/20	9.6 ~ 10.0
x1	9.7V		

X5, X2 modes

The signal flow for X5 and X2 modes, which are also considered fast (or not slow), is the same as for the normal speed mode, but capstan FG signal frequency is different: 3,750 Hz and 1,500 Hz for X5 and X2, respectively. Therefore, the output voltage is also different. A timing chart is shown in Figure 2-194.

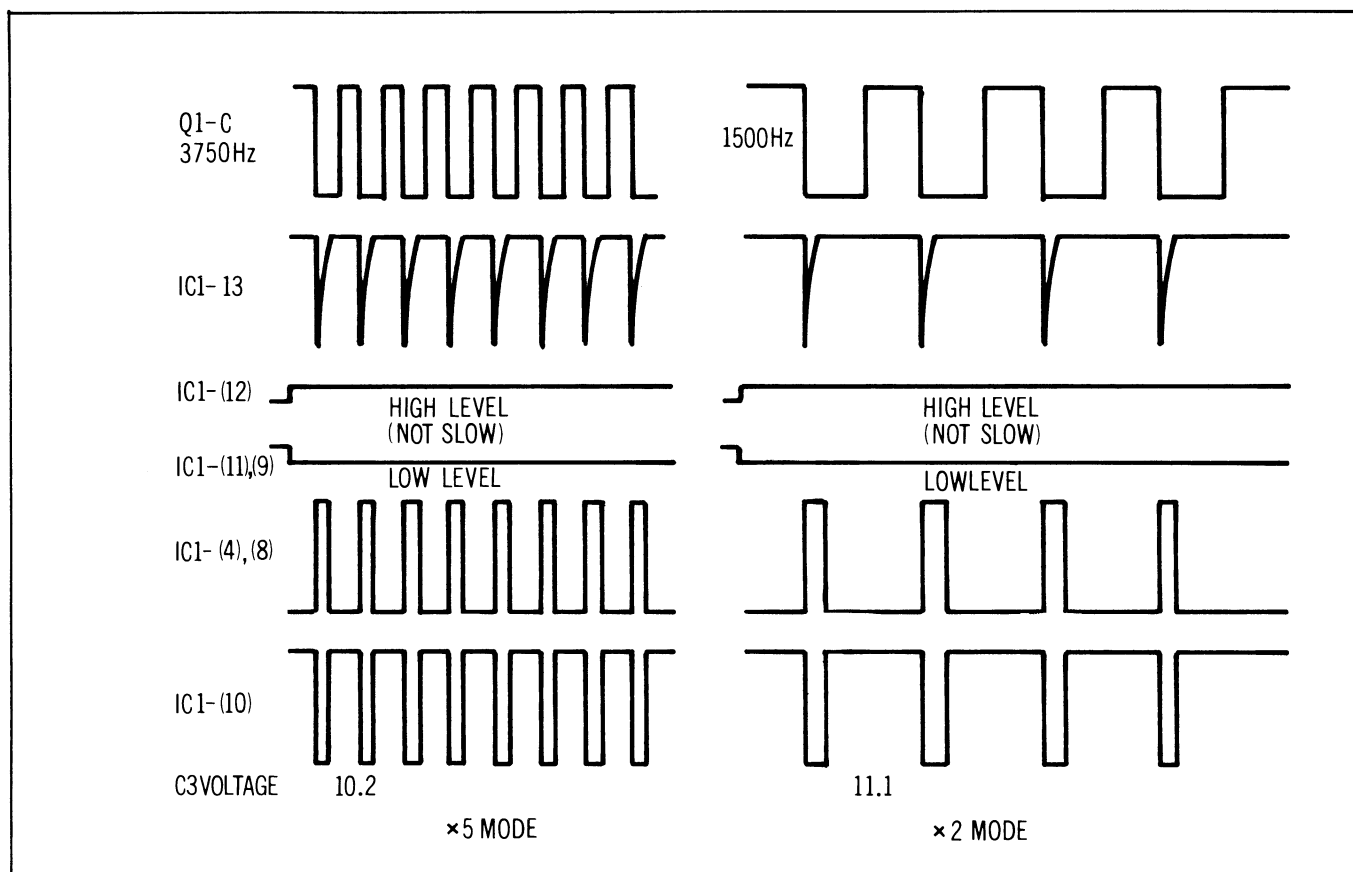


Figure 2-194

X1/5, X1/20 modes

In the slow modes, the capstan FG signal, 150 Hz in X1/5 mode or, 37.5 Hz in X1/20 mode, is amplified by Q1 as before, and goes pin (13) of IC1 after differentiating by C1 and R12.

The other gate input, pin (12) of IC1, is a low, supplied from the inverter IC1-(3) during SLOW mode. Since IC1-(5) is always a high level during SLOW mode, IC1-(4) always remains a low. The output negative pulse still appears at IC1-(10).

The timing chart is shown in Fig. 2-188.

UNLOADING

The cmos switch, IC2-(1), (2) and (3), closes during the unloading mode to provide a DC voltage which is divided from +12V by R9 and R10.

Therefore, a DC voltage is supplied to the sawtooth generator circuit for every mode: X5, X2, X1, X1/5, X1/20 and unloading mode.

Sawtooth Generator

The ramp generator circuit consists of IC3-(5), (6) and (7), Q4, Q5, R38, R41 and C11 generates sawtooth wave.

The slope of sawtooth is determined by the RC network C11, R41, R38 and the constant current generator IC3/Q5, which is controlled by the DC made from the Capstan FG. R38 is the major element except in the slow modes. In the slow modes, R38 is cut from the circuit by turning Q4 off, and R41 remains. Q6 drives Q7 to discharge C11, starting a new sawtooth. See Figure 2-197.

The slope of sawtooth wave is changed for the each mode by the DC level at IC3-(5).

That is, the slope of X5 mode is steeper than the slope of X2 or normal speed mode as shown in Figure 2-195. The positive pulse from the Reel FG IC3-(1) turns on Q7, discharging C11 and limiting the maximum level reached.

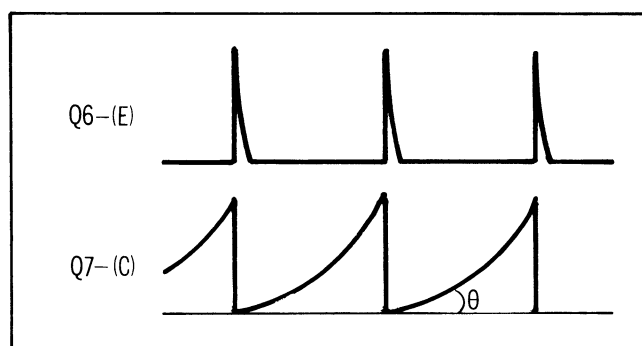


Figure 2-195

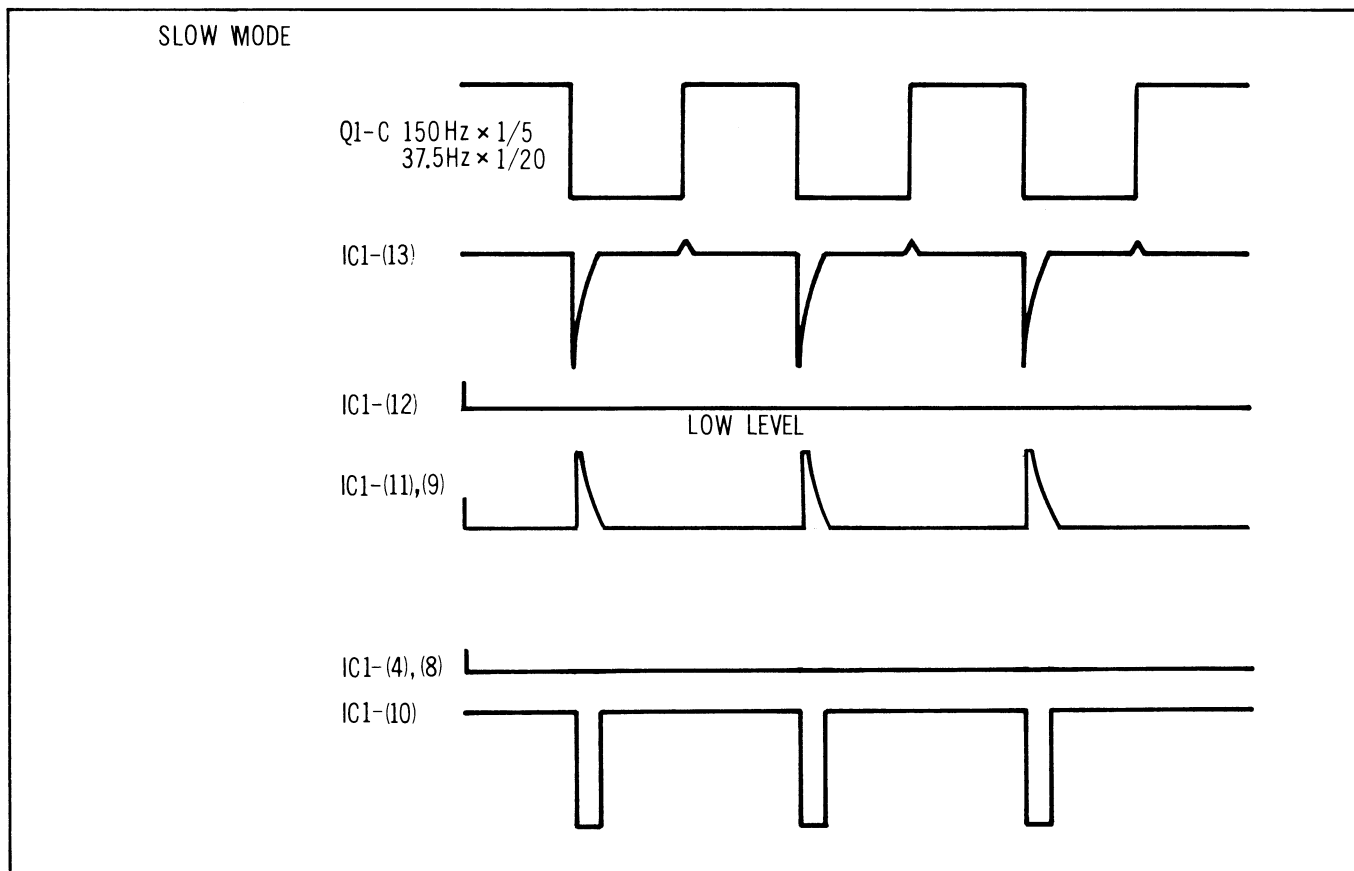


Figure 2-196

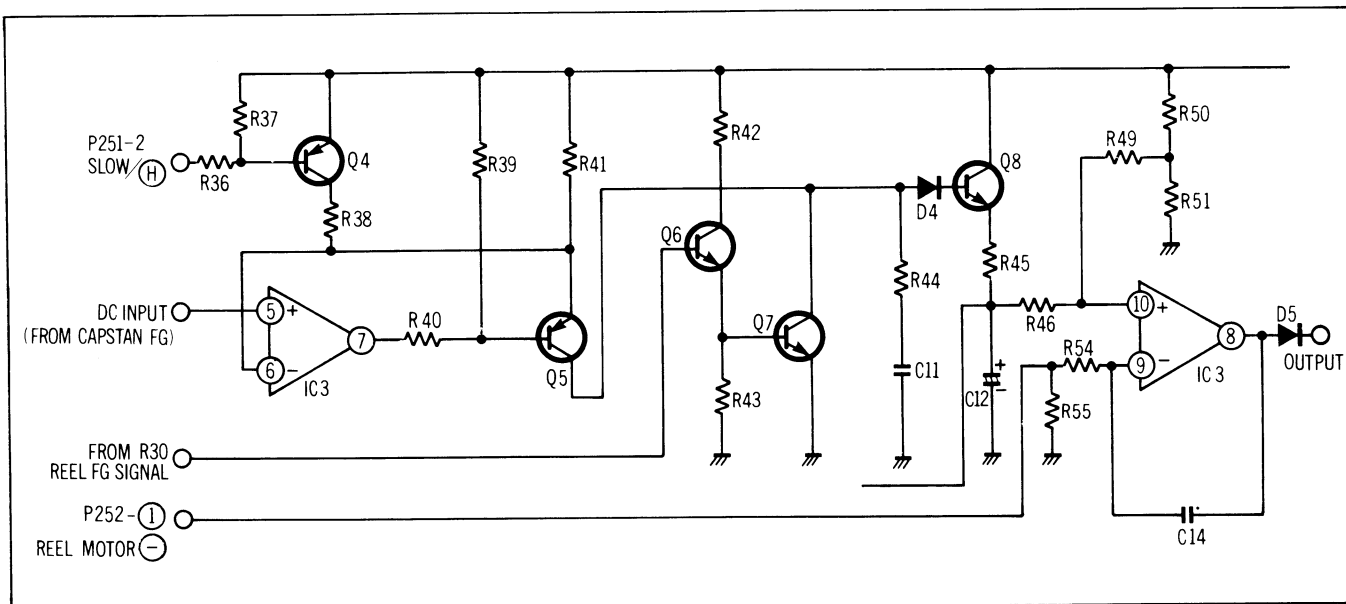


Figure 2-197

Peak Hold and Rectifier

The sawtooth at the collector of Q7 is then applied to the base of Q8 through D4 and filtered by R45 and C12. The peak value of the sawtooth wave is held in this circuit by C12.

DC voltage at IC3-(10) is amplified and supplied to the reel motor drive circuit, shown in Figure 2-199.

Q6 drives Q6308 to supply +18 to the motor. When the input to Q6 falls, Q15 turns off and Q18 turns on to be a counter E.M.F. brake with R84. R55 provides current sense for IC3.

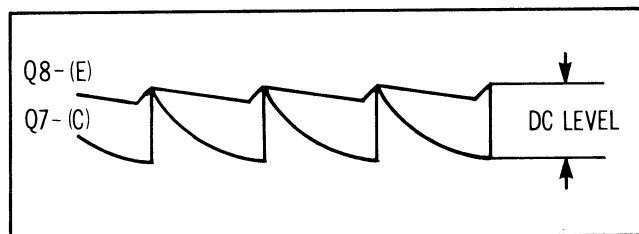


Figure 2-198

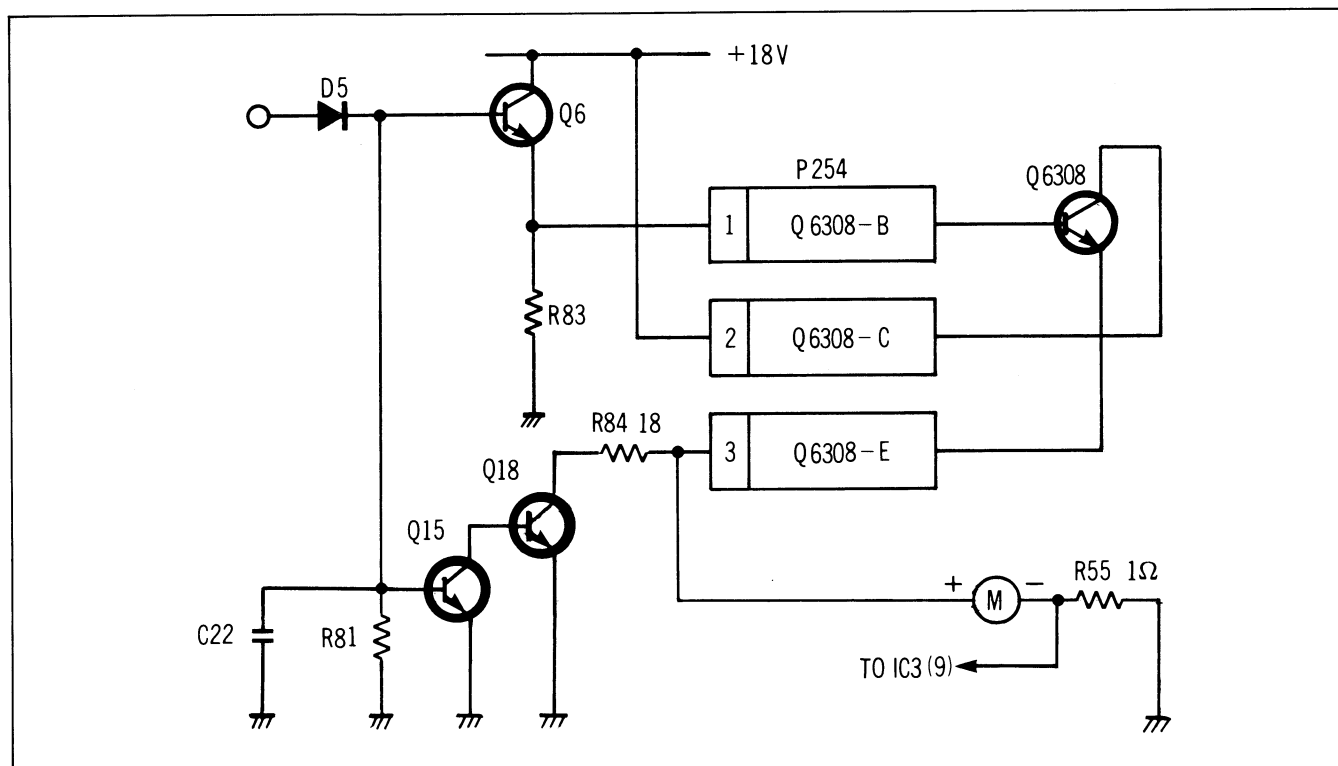


Figure 2-199

Tape Tension Adjustment

In forward mode, 60 ~ 70 grams of tension is necessary. R52 serves as an adjustment in the voltage divider R46, R47, R52 (See Figure 2-200).

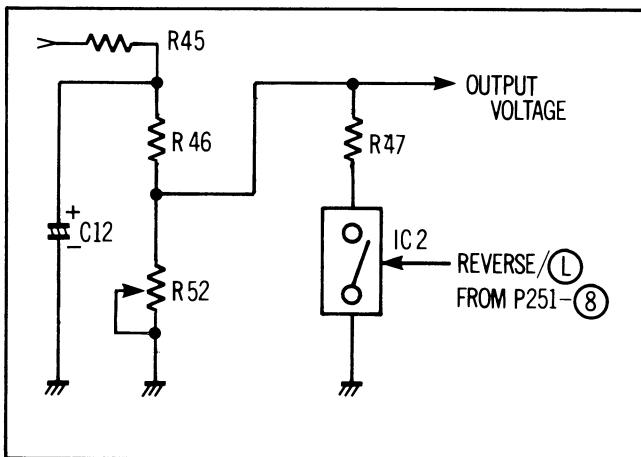


Figure 2-200

In the Reverse mode, the tape is not pulled past the heads by the capstan, but by the takeup reel. The capstan just regulates tape speed, so it is necessary to give the motor more DC voltage to increase the torque. The DC voltage is increased by removing R47, since the Switch IC2-(6), (8), (9) is open during the reverse mode (See Figure 2-200).

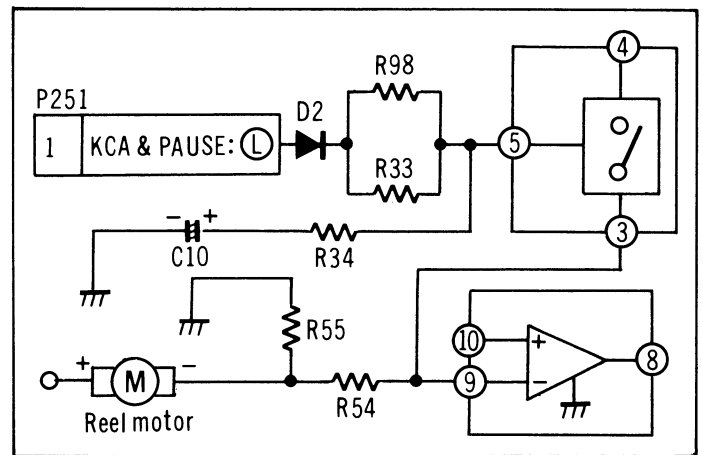


Figure 2-201

Tape Tension, Pause Mode

In the Pause mode, a high appears at P251-(9). This turns Q19 on and the positive terminal of C12 becomes zero voltage, and the reel motor will stop. The tape will be stopped as well, but the tape may fall slack, lose contact with the head cylinder and a useable still picture will not be possible.

In order to create a little tension, a torque proportional to a fixed voltage is needed. This voltage, which is divided by R50 and R51, is applied to the reel motor as shown in Fig. 2-202.

Now a still picture can be observed during pause. If a KC type cassette is used, the tape is not to be scanned in the pause mode, so a High appears at P251-(10) and IC2-(3,4,5) is turned on. R53 supplies a positive voltage to IC3-(9) to cut off motor drive and allow the tape to be slack. See Fig. 2-201.

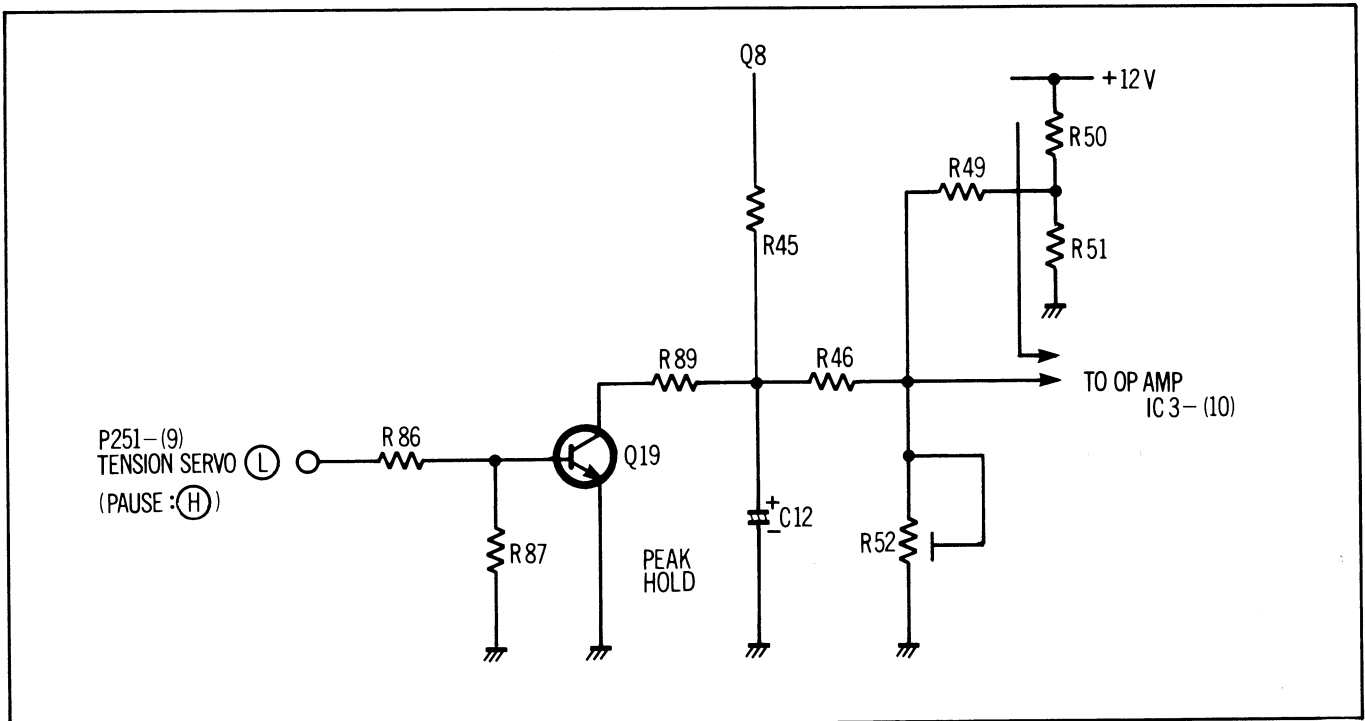


Figure 2-202

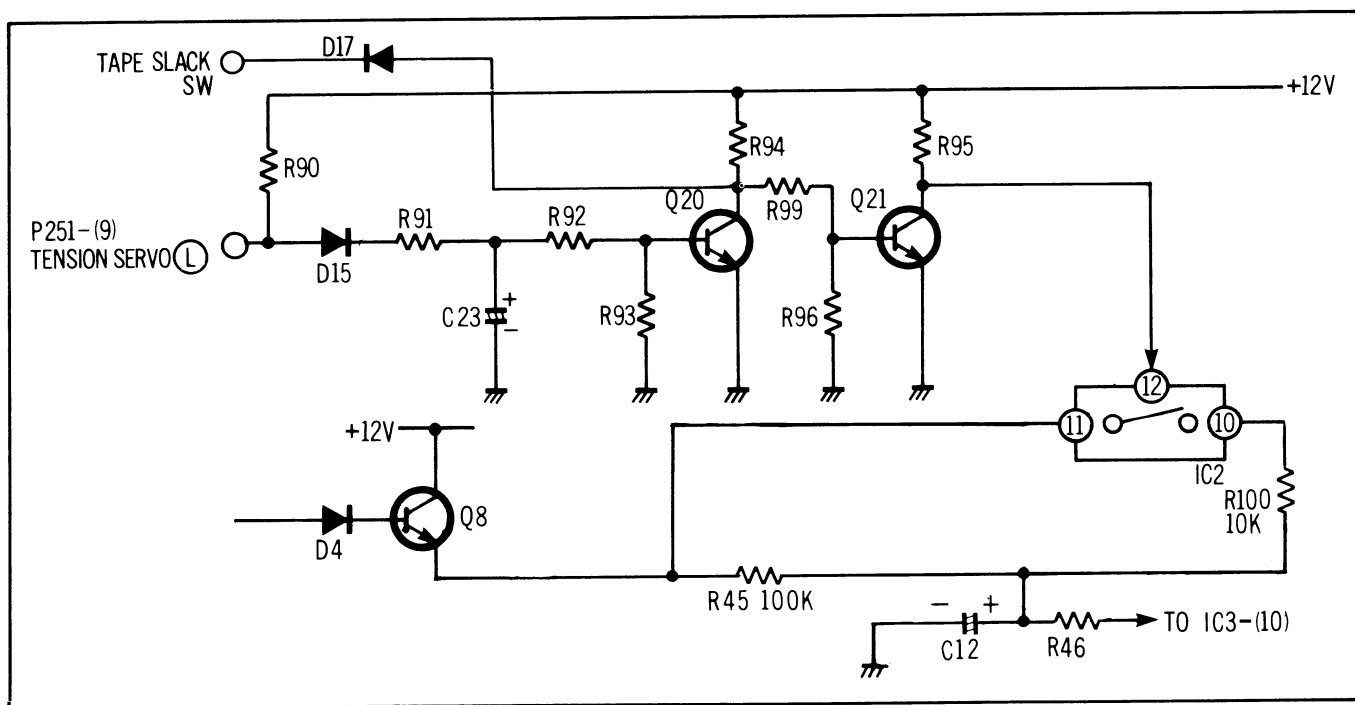


Figure 2-203

When the pause mode is released, tape slack will occur since C12 is discharged completely and the capstan is now engaged. A quick charge is needed to provide rapid tape takeup. The IC Switch, IC2-(10), (11) and (12), performs this quick charge by shunting R45 with R100. This switch is also on if the tape slack switch in the transport comes on, to pick up any tape slack (D17). See Figure 2-203. When the Pause mode begins, a high turns Q20 on and charges C23.

Q21 turned off and +12V is supplied to pin (12) of IC2 through R95. During the Pause mode therefore R100 is paralleled with R45.

When the Pause button is released, P251-(9) becomes a low instantly, but the base of Q20 is delayed 0.5 second by C23, so the collector of Q21 remains high. Since the resistance value (R45) is reduced, C12 is charged quickly. (See Figure 2-204).

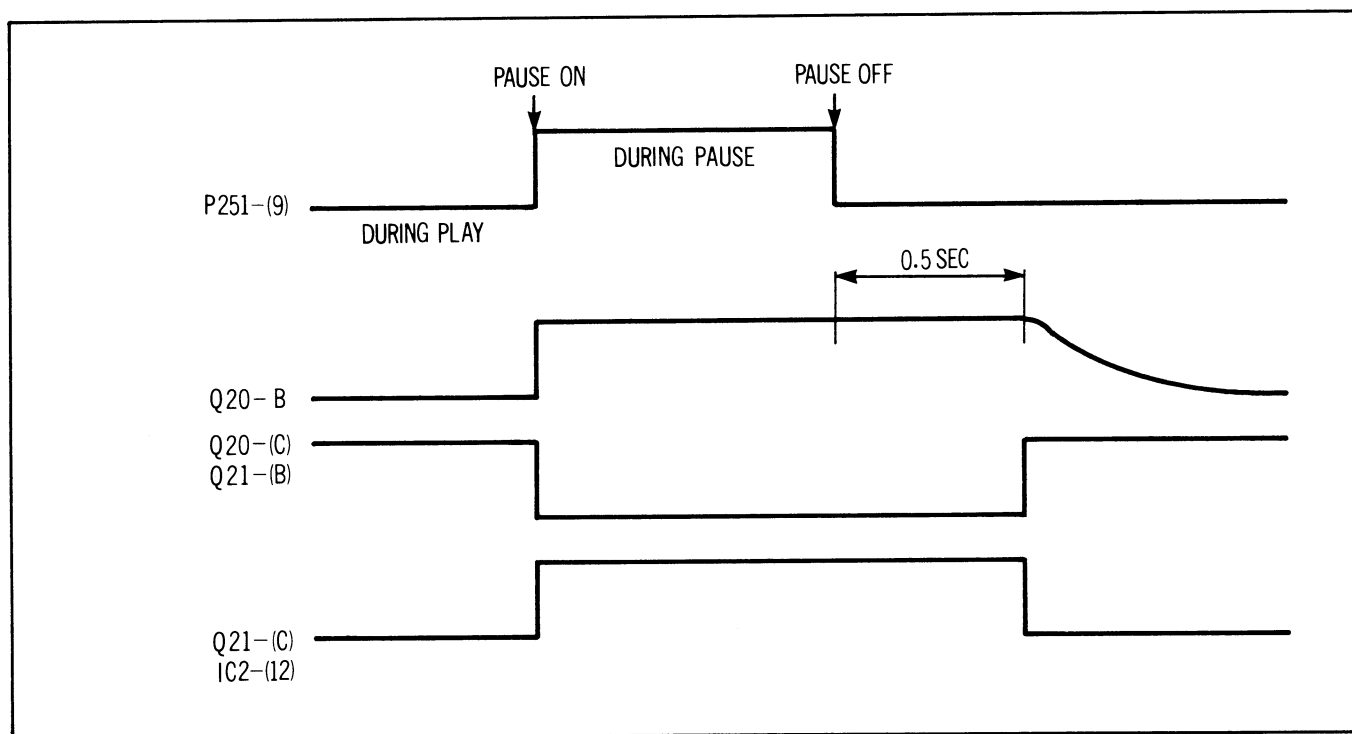


Figure 2-204

Fast Forward and Rewind Mode

Both the supply and takeup reels have ring magnets and a Hall effect IC located under the edge of each reel.

During the Fast Forward or Rewind mode, the Hall IC detects the magnets. The Supply IC output pulses appear at pin (1) of connector P251 (Takeup reel, pin (4) P251), are

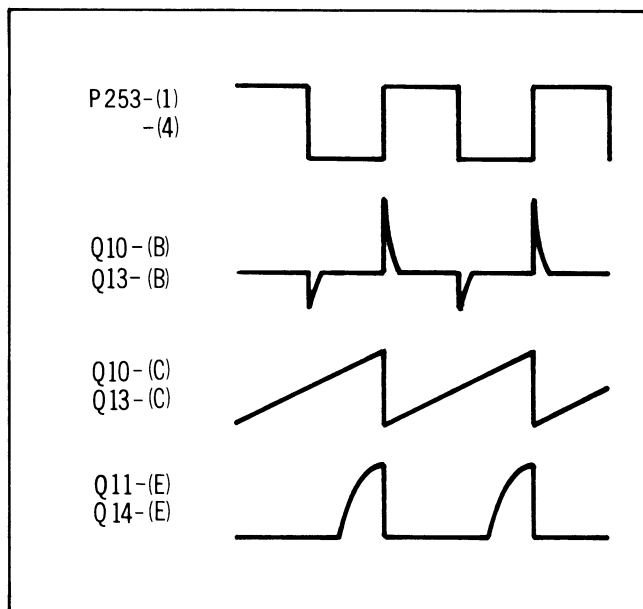


Figure 2-205

differentiated by C15 (Takeup reel, C18), and then a sawtooth wave is generated by R62 and C16 (Takeup reel, R62 and C19). Next, the peak value of the sawtooth wave is integrated by R63 and C17 (Takeup reel, R73 and C20). Finally, both of the supply and takeup DC voltages are mixed. This resultant DC voltage is amplified by IC3-(12), (13) and (14) to serve as the reel motor drive through D13. (See Figure 2-207).

The structure of Take-up and Supply Reels and the waveforms are shown in Figure 2-205 and 206.

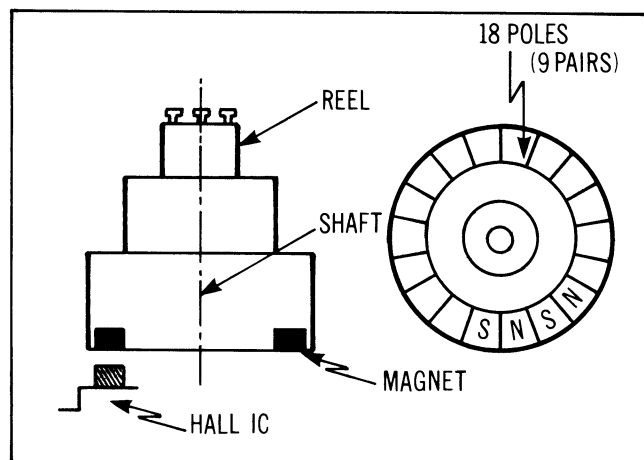


Figure 2-206

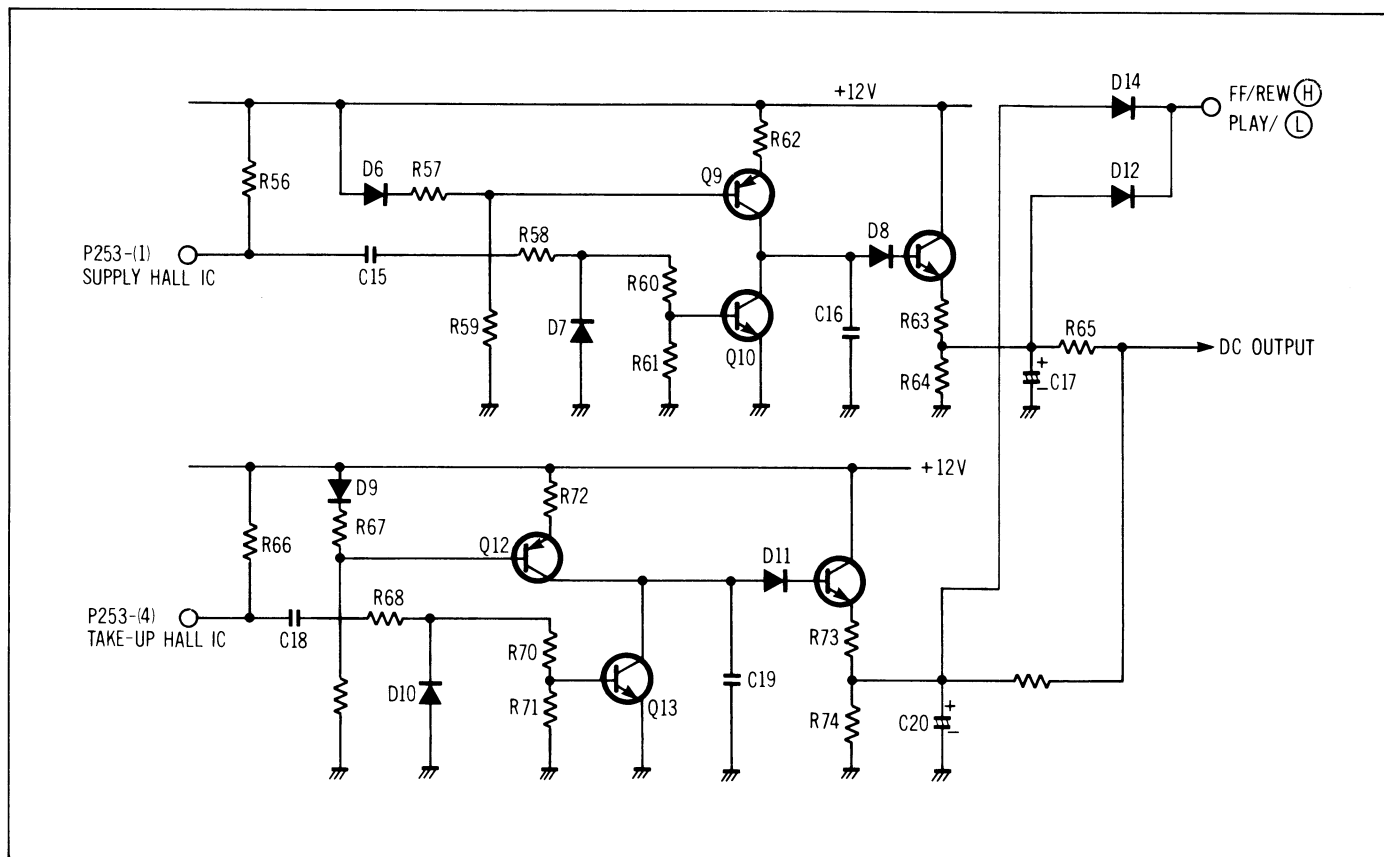


Figure 2-207

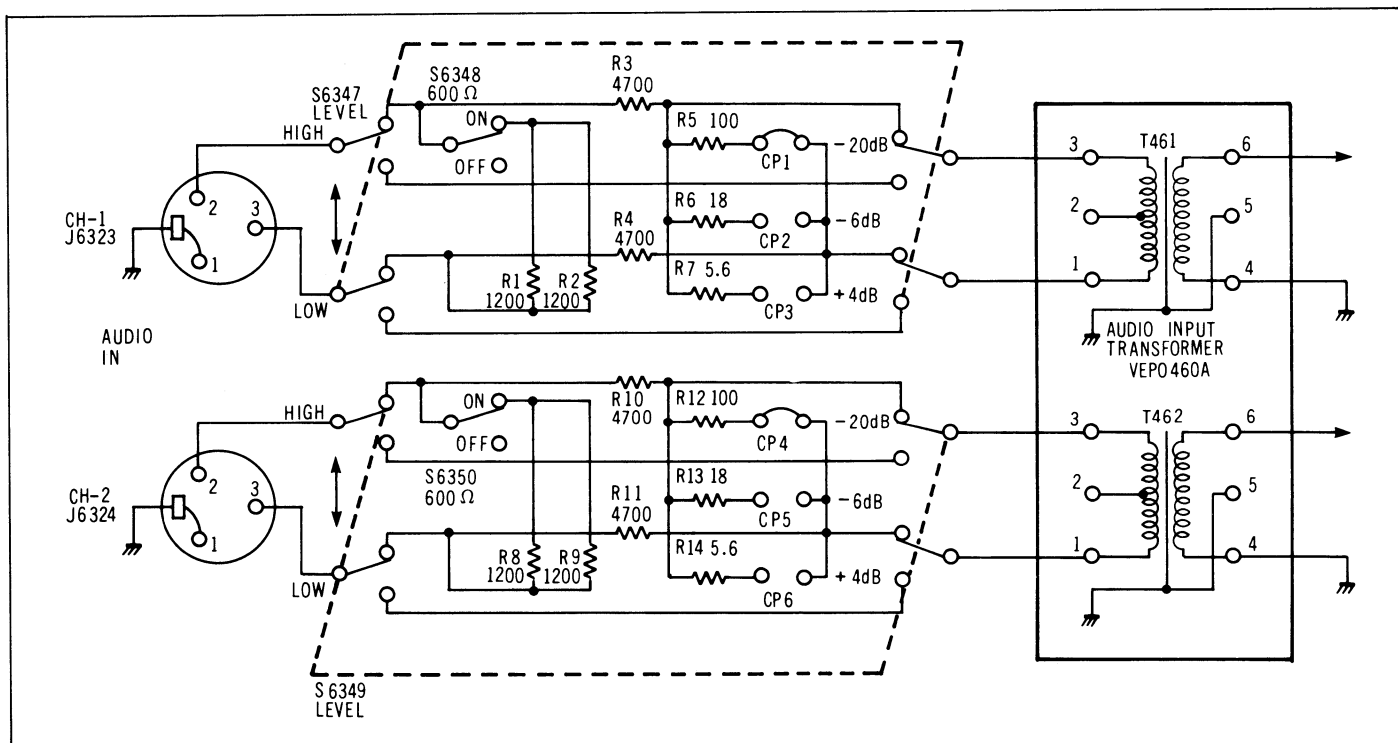


Figure 2-208

Audio Input

The audio input is transformer coupled to present either a high or low level input. The input level is switch selectable on the rear panel between "high" and "low", and in the high level position, a 600 ohm termination may be switched in and out.

(In the low level position the input impedance is fixed).

However, in the high level position, the nominal input level may be changed internally to be -20 dB, -6 dB or +4 dB by moving solder jumpers on the Audio Input Level Select circuit board, VEP00585. CP in the schematic designates Cut Point, and the appropriate point is bridged for the level desired.

Audio Output

In order to provide Line level audio at 600 ohms balanced, a separate Audio Line Amplifier is used. This circuit has two identical sections, so only channel 2 will be discussed.

The Channel 2 audio signal is supplied from the Audio Circuit (VEP0452) to P451-9. A level adjustment R13 sets the signal to IC2, AN7130.

IC2 is a 4.2 watt audio amplifier with provision for external feedback control. The audio signal goes to the input at pin 5, and the output is pin 1. Feedback for output stage protection is R14 C24, and negative feedback is C18, 19, R14, 15, with also trims the frequency response. C15 is high frequency stabilization, and C20, 21, 22 are decoupling.

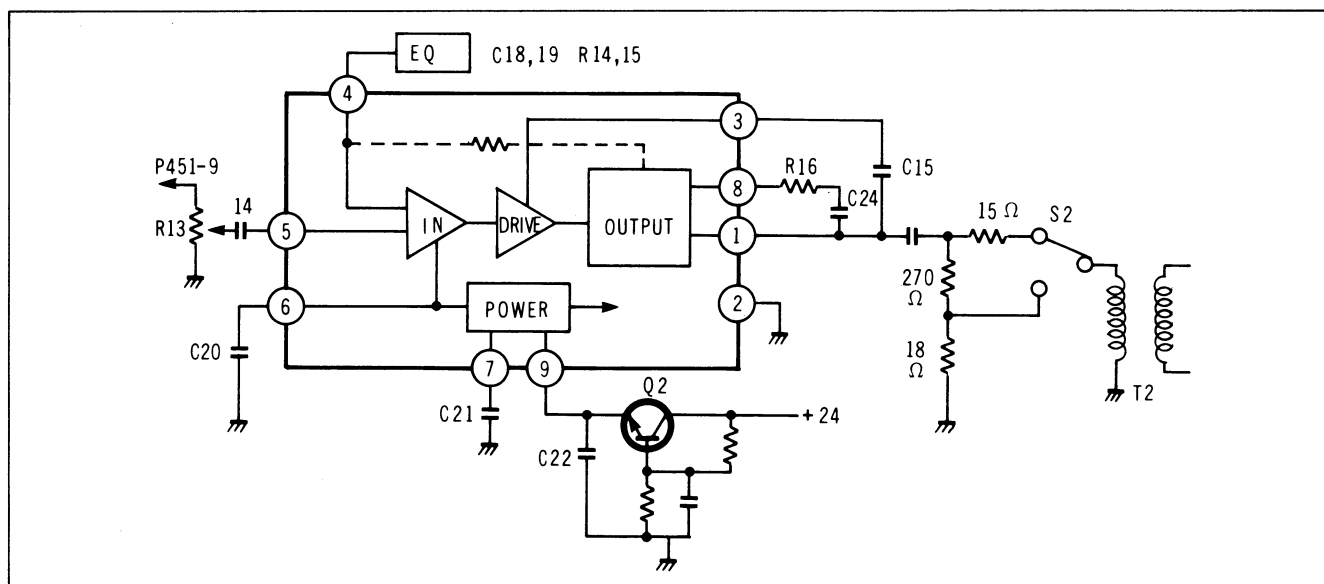


Figure 2-209

Q2 forms an active power filter to suppress power supply noise. S2 switches between un-attenuated (+4 dB) output through R17 or attenuated (-6 dB) output through R18, R19. This switch is interval, but accessible from the top cover. T2 is a voltage step up to 600 ohm and balances the output. Output channel 1 functions in the same fashion.

Audio Circuit (VEP0452)

General

The audio circuit board, VEP0452A1, is used for all audio recording and playback, bias for recording, and allows dubbing of audio over channel 1 and channel 2 on insert editing mode. The audio circuit has two channels, CH1 and Ch2, which are almost identical. Channel 2 is considered the main audio channel since it is further removed from the edge of the tape.

Record Mode

In the record mode, the CH1 section can accept one of two signals: either the signal from the microphone or the Line signal, selected by use of the Mic jack. The CH2 section however utilizes the CH2 microphone signal or the audio signal selected by the input selector on the front panel (TV or Line). The microphone jacks on the front panel have precedence and connect directly to preamplifier Q1 and Q16 to amplify the low microphone signals (about -60 dB) for CH1 and CH2 respectively. If the Line inputs are used, the high level signals are attenuated by voltage divider resistors at the microphone jack, and then applied to Q1 and Q16. Then, after amplification, the signals are routed to the second stage amplifiers (Q2 and Q17, respectively). Ch2 will accept a microphone or line signal only when the input selector switch is set to "Line". If the selector is set to "TV", the high level signal from the 8 pin connector goes to the second stage amplifier Q17. To accomplish this, the output of the CH2 preamplifier is sent through P46-2 (1st out) to the Line terminals of the selector switch. The signal selected by the switch is then connected to Q17 through P46-3 (2nd in). For both CH1 and CH2, the second stage amplifier signals are sent to their respective tone amplifiers inside IC1 and IC2, which simply act as another stage of amplification. The amplified audio signal is then split. One path is for rectification, to obtain an AGC signal. The AGC signal is used to control the gain of the second stage amplifiers, Q2 and Q17. AGC/Manual mode switching is done by Q10 (CH1) and Q25 (CH2). The second path is used for head-phone and line output signals. Finally, the audio signal for each channel is mixed with the bias signal and sent to the recording heads.

Figure 2-200

Playback Mode

In playback, the signals picked up by the CH1 and CH2 heads are sent to IC1 and IC2 respectively. Here the signals undergo playback equalization which boosts the low frequency signals and attenuates the higher frequencies. The outputs of the equalizer sections are amplified by several stages and headphone, and line audio signals are developed.

Bias

A 75 kHz bias signal is also made on the audio circuit board by an astable multivibrator, Q33, Q34 and T3. This signal is mixed with the audio signals and applied to the audio heads and applied to the audio erase heads for erase via relays RY3 and RY4.

Audio Dub (Insert Edit)

When in the playback mode, it is possible to re-record (Insert Edit) over either the CH1, CH2, or both audio tracks. When the audio Insert Selector (CH1 or CH2) are on, the Audio Dub mode puts the audio electronics into the Record mode.

Detailed Description

Record Mode

This description will apply to both CH1 and CH2 although diagrams will shown components identified for CH2. Since a microphone may be used for the input, the first stage amplifier, Q1 (Q16 for CH2) provides about 60 dB of gain. In CH2, the output of this first stage is sent to the input selector switch, and either this signal or the TV input may be selected and applied to the second stage amplifier, Q17. CH1 has only MIC or LINE chosen externally. The CH1 signal is sent directly to the first stage amplifier, Q1. See Fig. 2-211.

After this stage, the signal is sent to a transistor switch Q4

for CH1, Q19 for CH2. In the record mode, these transistors are ON, thus passing the signals to their respective tone amplifiers in IC1 and IC2. This is simply an amplification stage between Pins (3) and (5). The output at Pin (5) is then applied to another amplifier inside the IC at Pin (6). The output of this stage at Pin (10) is then goes out to P49-(5) CH1, P410-(5) CH2 as a Line out (TV). See Fig. 2-212. Another output at Pin (5) of IC1 is then sent to the amplifier Q36 (CH1) and Q38 (CH2). The output of this stage is sent to Pin (7) of IC1 for CH1, IC2 for CH2 to amplify the signal and amplified signal appears at Pin (9) of IC1 for CH1, IC2 for CH2. Then this output is rectified and filtered by D10 and C37 CH1 (D22 and C88 Ch2) to obtain a DC level which represents the average level of the audio signal.

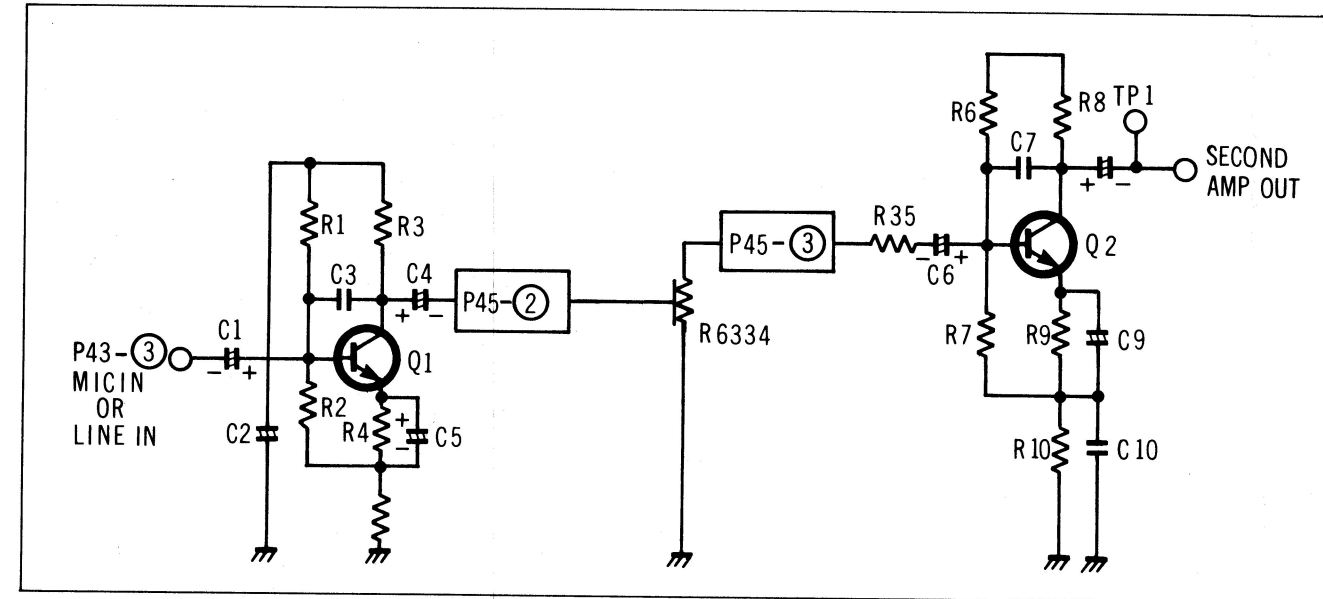


Figure 2-211

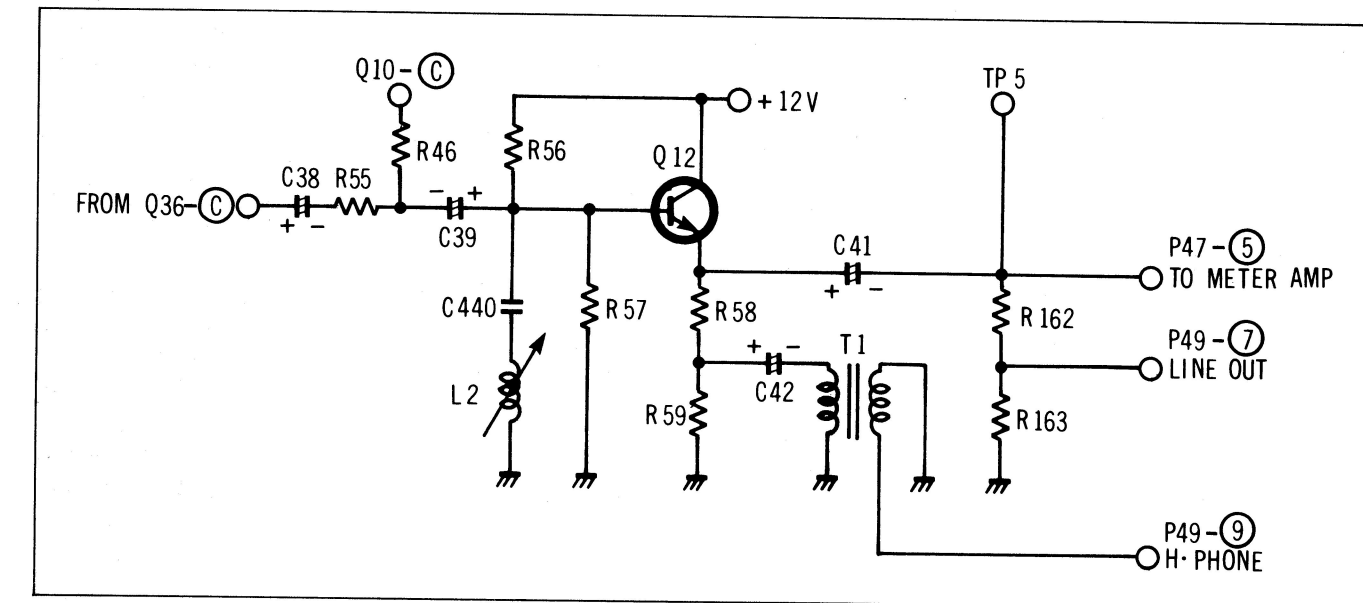


Figure 2-213

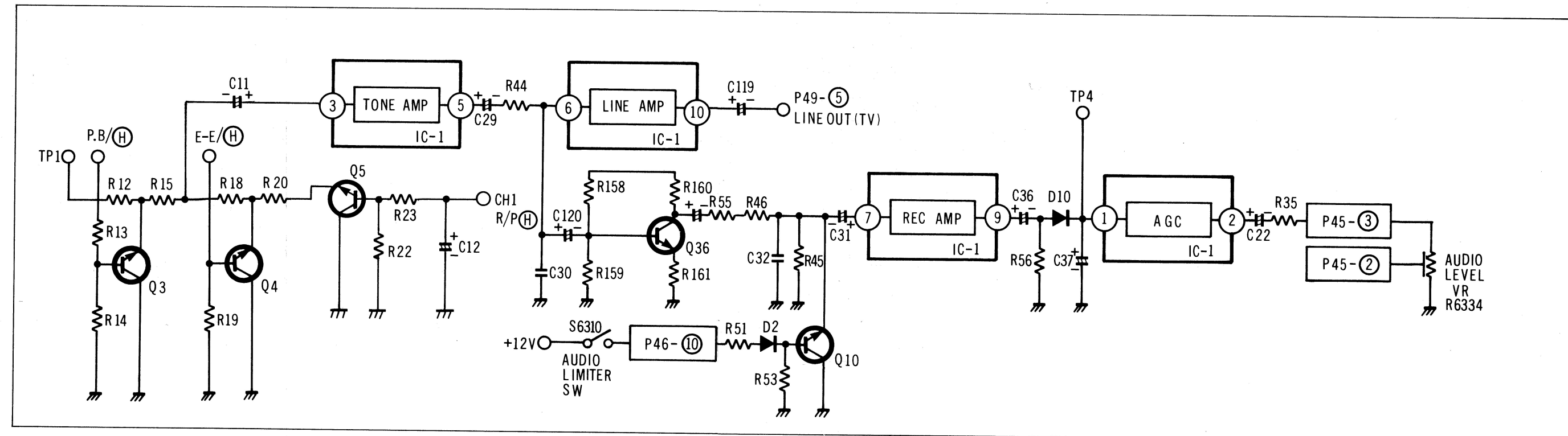


Figure 2-212

This DC signal is supplied to the AGC detector inside IC1 and IC2, Pin (1). The AGC action helps to maintain a constant audio signal level for improved S/N for recording. The output of the AGC detector at Pin (2) is used to control the gain of the second stage amplifiers, Q17 (CH2) and Q2 (CH1). As the level of the audio signal increases, the rectified DC level also increases which lowers the resistance between Pin (2) and ground. This shunts some of the signal from the second amplifier stage, so there is less gain. The converse is true in instances where the audio signal is low.

When the Audio Limiter Switch (S6310) is ON, (no AGC), +12V is supplied from the connector P46-10 to Q10 and Q25. Therefore, Q10 and Q25 ground Pin 7 of IC1 and IC2 and AGC loop is defeated. Audio level is set by R6334 (CH1) and R6333 (CH2) on the right operation panel. The output of Q36 for CH1 (Q38 for CH2) is then sent to the output amplifier Q12 for CH1 (Q27 for CH2). The output of this stage goes out to the connector P47-(5) for the Meter Amp. (connector P48-(5) for CH2), while another output goes out to the connector 49-(9) for Head Phone out (connector P410-(9) for CH2) and finally to P49-(7) for Line out (P410-(7) CH2). The same input to Q12 is also the input to the recording equalizer Q13 (Q28 CH2). See Figs. 212, 213.

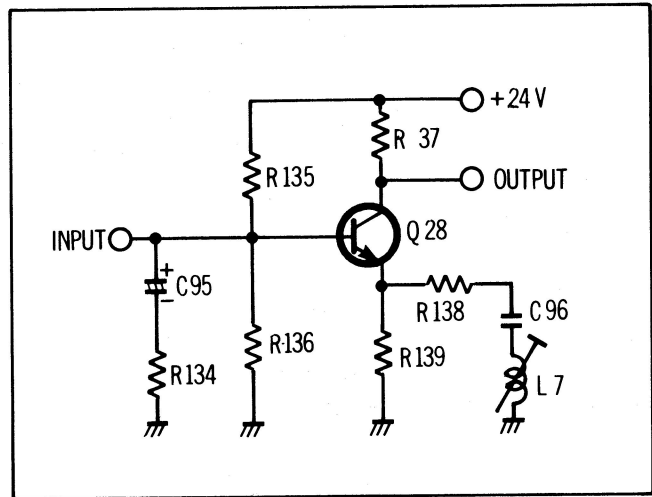


Figure 2-214

The series resonant circuit shown in Figure 2-214, consisting of C96 and L7 in the emitter of Q28, increases the gain of this stage by 11 dB at 12.5 kHz by effectively creating a bypass around R139. The overall amplitude vs. frequency response of this stage is shown in Fig. 2-215.

This equalized signal is then passed to another transistor switch Q29 CH2 (Q14 CH1). The collector of this switch is open in the record mode (transistor is off) and this allows the equalized signal to pass through the constant current circuit consisting of C99 and R140 CH2 (C48, R67 CH1). The equalized signal is passed through this R-C network to compensate for the inductive reactance of the audio head itself. If it was not used, at low frequencies the inductive reactance would be very small and a large current would flow; at high frequencies, the inductive reactance would be high, and little current would flow.

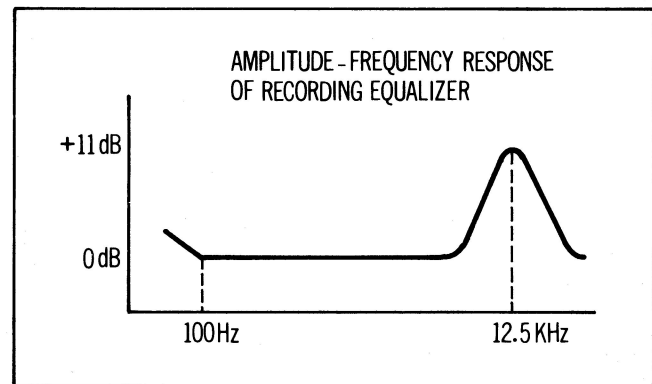


Figure 2-215

So, because of the R-C network, a constant current flows through the audio head for all audio frequencies. After this network, the audio signal passes through the bias trap, C101 and L8 CH2 (C50 and L4 CH1) and is mixed with the bias signal. The bias trap is necessary to keep the bias signal from leaking back into the audio circuits. The mixed audio and bias signals are then applied to the appropriate heads.

During recording Q11 (CH1) and Q26 (CH2) turn on to energize relays RY1 and RY2, respectively. This connects the audio heads to the mixed audio/bias signal for recording. In the E-E modes, Q8, Q23 are ON, and Q7 and Q22 are OFF. The high level at the collectors of Q7 and Q22 drive Q4 (CH1) and Q19 (CH2) ON to short out the signals from Q6 (CH1) and Q21 (CH2). This prevents any contribution of Q6 and Q21 (the playback amplifiers) from appearing in the record audio signal.

Bias

In the Record mode +24V from P412-2 is applied to the two primary center taps of T3. This starts the astable operation of Q33 and Q34. The frequency of oscillation is 75 kHz. Transformer T3 couples this signal to CH1 Bias Adjust C113, CH2 Bias Adjust C114, and to the center contact of relay RY4. The bias adjustments allow for setting the bias signal level applied to each head. Relay RY3 and RY4 are controlled by Q31 and Q32. They are driven by the control logic to select either or both erase head windings as may be required. Chokes L10 and L11 serve in series in place of an erase head not in use.

Playback mode

Q15 and Q30 are turned ON placing Q14 and Q29 ON. This is not the E-E mode, so the level at P47-(2) and P48-(1) is low. This turns OFF Q8 and Q23 which then turns on Q7 and Q22. Further, this places Q3, 10, 18, 25 ON, and Q11, Q26 and Q19 OFF. The playback signal picked up by the audio heads is sent to the equalizer amplifier. Because the relays RY1 and RY2 are not energized, the playback signal is routed directly to IC1 (CH1) and IC2 (CH2) Pin (16).

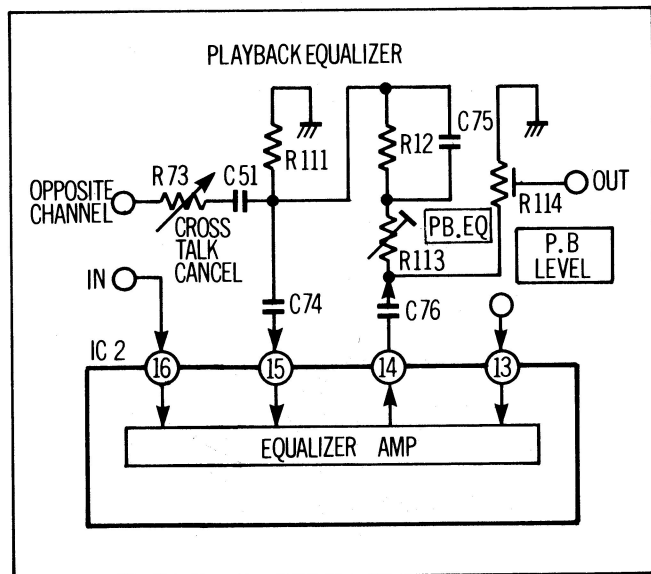


Figure 2-216

See Figure 2-216 and 217. The purpose of the playback equalizer is to compensate for the head characteristics and the record equalization curve. The overall effect (total characteristic) of the playback equalizer can be seen. The equalizer characteristic, determined by the frequency selective network of capacitors and resistors between Pins (14) and (15) of IC1 (IC2) has the inverse shape of the playback head response. The combined result is a nearly flat curve.

The curve shape of the playback equalizer is determined by R40, CH1 and R113, CH2. The output level of the equalizer is determined by R41, CH1 and R114, CH2.

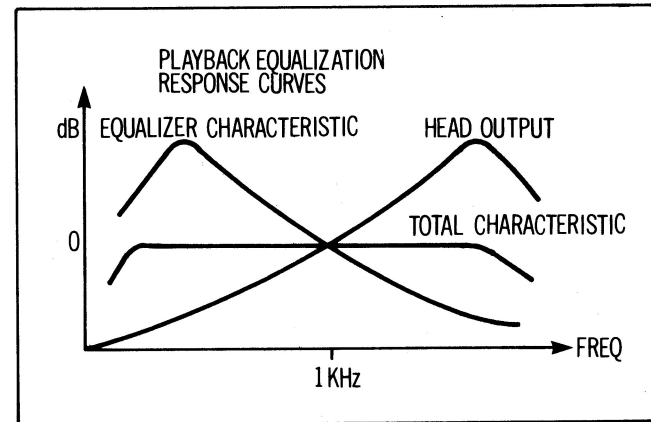


Figure 2-217

The output of the equalizer is sent to another amplifier stage, Q6 CH1, and Q21, CH2. This stage of amplification is followed by a 75 kHz bias trap in CH1 and CH2. This bias trap is used to block any bias signal which might get into the CH2 (CH1) audio playback circuit when the CH1 (CH2) section is recording in the Audio Dub (Insert Edit) mode.

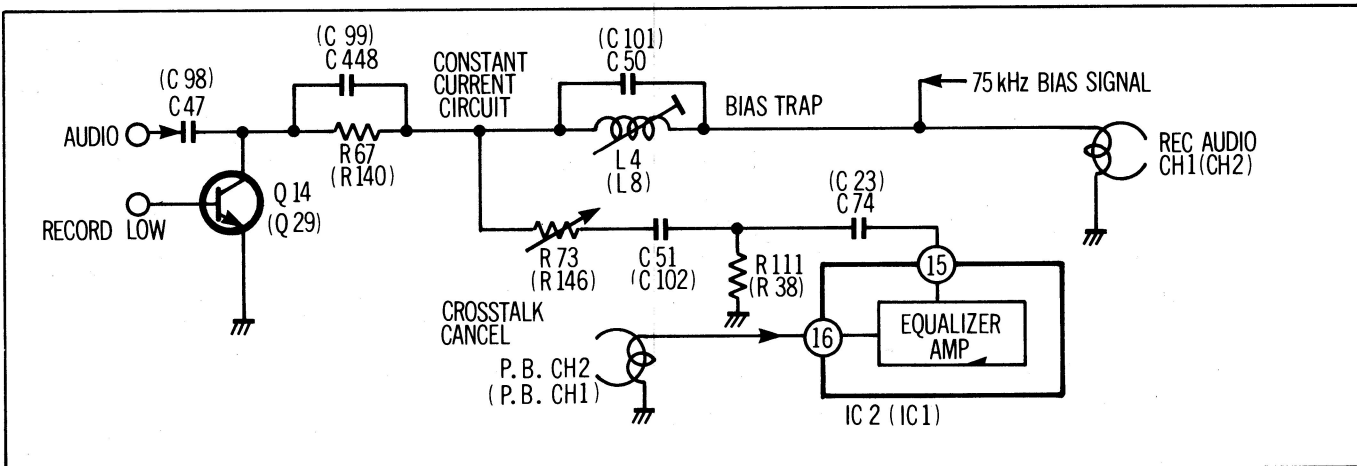


Figure 2-218

Following this amplification stage is a transistor switch, Q4 (CH1) and Q19 (CH2) which is turned OFF so that the audio signal is not routed to ground, but to the tone amplifier contained in IC1 (CH1) and IC2 (CH2).

The headphone and line outputs are obtained in the same fashion as that described in the Record Mode section.

The output of the recording equalizers is routed to ground by the turning on of Q14 and Q39.

Insert Edit

In the Insert Edit mode, either CH1 or CH2 sections can be placed in the record mode while the other is in the playback mode.

When the CH1 Audio Insert Selector is ON and CH2 is OFF, CH1 is placed in the record mode by the high signal (+12V) at P48-3 and the +24V at P412-2. CH2 stays in the playback mode.

The Bias oscillator (Q33, Q34) is turned on and functioning. Q31 is OFF, thereby keeping relay RY3 de-energized-this applies the bias (erase) signal to the audio erase head which just erases the audio CH1 track.

The high level audio applied to audio head CH1 may induce a signal in the head coil used for CH2. This leak or crosstalk signal would then appear in CH2.

To prevent this, a crosstalk cancelling adjustment is provided. See Figure 2-218.

Notice R73 which determines the amount of signal flow between the constant current network in CH1 and the equalizer amplifier of CH2. The crosstalk signal as picked up by the CH2 head and appearing at Pin (15) of IC2 is out of phase with the signal from the constant current network in CH1. Therefore, signal cancellation will occur when R73 is adjusted to pass an out of phase signal of the same amplitude as the crosstalk signal. When the CH2 Audio Insert Selector is ON and CH1 is OFF, the function of the circuit is same except that R146 is the adjustment.

AU-700 Time Code

The AU-700 has provision for SMPTE Time Code to be recorded in two positions on the tape. For the post production addition of time code, it can be recorded in the Audio Channel 1 position, but utilizing a separate head and electronics.

The same time code electronics can also record and play the time code signal in a unique address track, located in that portion of the tape reserved for video.

This time code address track is positioned so that, in conjunction with the relocated head switching point, the time code occurs during the vertical interval.

This is done because the video heads will read the time code transitions as well as the video FM signal, and they create a disturbance in the color signal. During the vertical interval, there is no color signal, so the disturbance can be overcome (See the Video Playback Section).

Figure 2-219 shows the physical layout of the signals on the tape. Switch S6303 on the rear panel controls the choice of time code location.

When the Audio position is chosen, the normal audio channel one electronics is muted by diodes D27 and 30 on the Audio Circuit board (VEP0452).

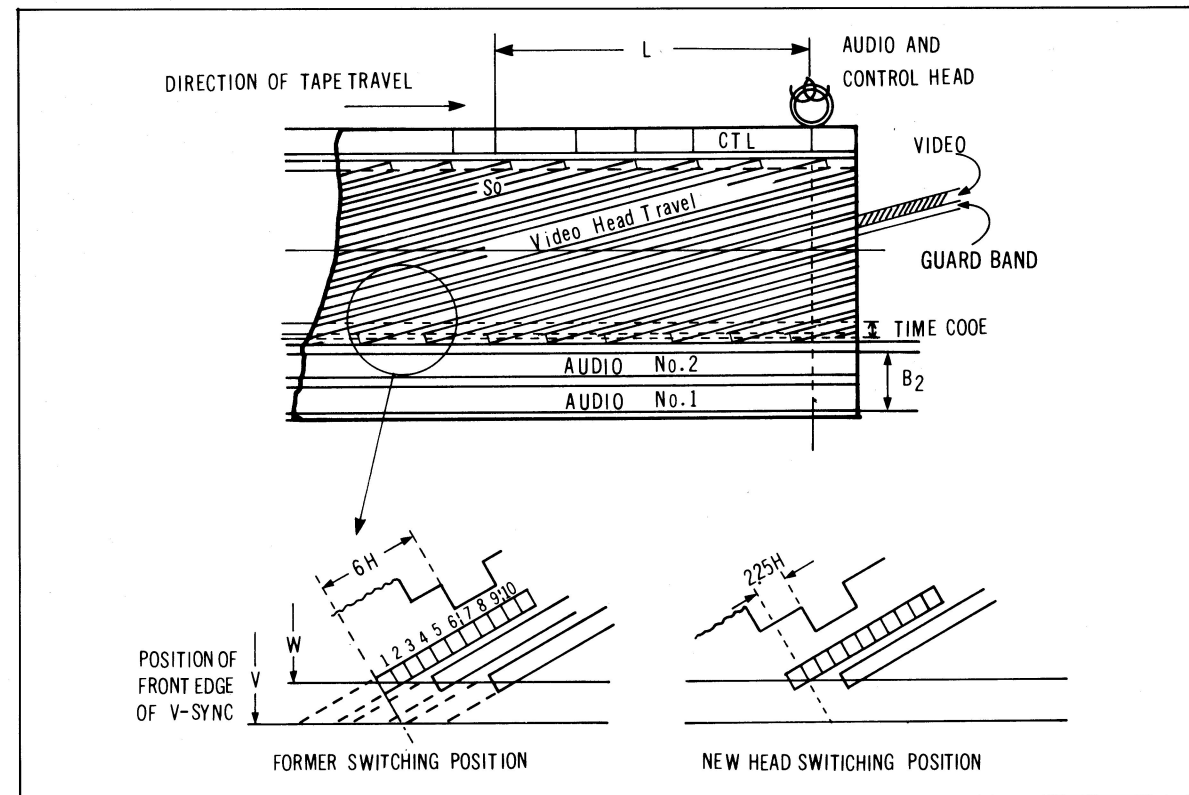


Figure 2-219

When the time code position is chosen, the system control gets a +12 input to inform the CPU, enable the time code jump (see flying erase) and the time address +12 also enables the time code lamp. In addition, this +12 goes to a relay located on the Full Erase/Audio/CTL/T.C. head assembly board (VJB00555) through P6330 pin 1. This relay switches both sides of two separate heads, as shown in Figure 2-220

Since the time code is recorded in the video area when the time code address track is used, if the flying erase heads were to pass over the address track some portion of the time code signal would be erased.

Therefore, the flying erase drive has two outputs, gated by a time code "jump" signal, which turns off the flying erase while the head pass over the T.C. address track. See the Flying Erase description in the System Control Section.

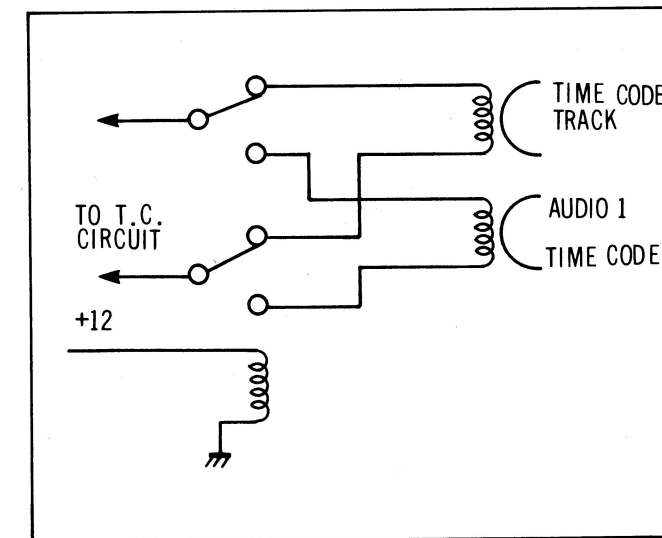


Figure 2-220

The Time code signal is an 80 bit per frame bi-phase signal in which is only the relative pulse width is important, not pulse polarity. It is recorded as saturated magnetic transitions without bias.

The time code signal comes from an external generator already encoded. It appears at P652-4, TP1, and is amplified by Q1 and limited by D1, D2, and passed to Q4, the record driver, and on to the T.C. head.

Q3 functions as a record mute when Time Code is not present, driven by the T.C. sense circuit which drives the T.C. Lamp, described below.

Q11 provides a head return path for record, while Q10 provide a return path in the play mode, since Q2 forms a Record high (P652-1) inverter. See Figure 2-221.

In playback, the signal goes from the head to IC1 to be amplified, and then to IC2 for amplification and limiting by D8 and D9, and then to emitter follower Q12. Q12 and Q13 form a differential switch, and in record Q13 is the active emitter follower and in play Q12 is active.

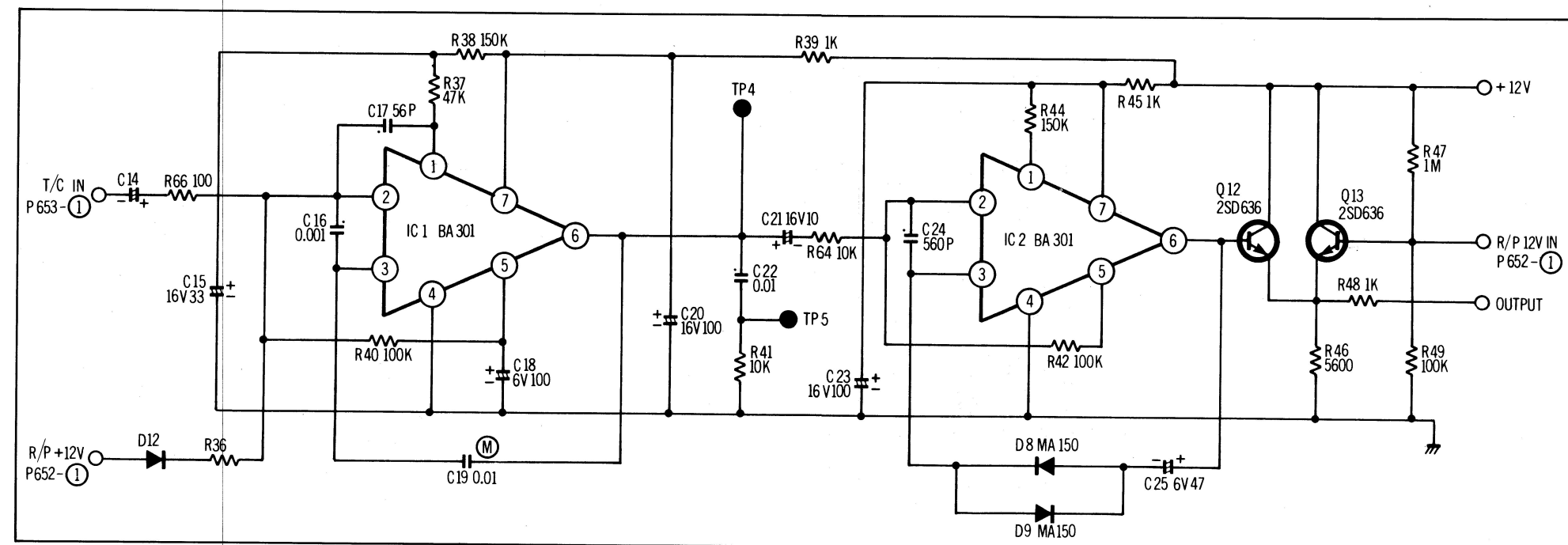


Figure 2-222

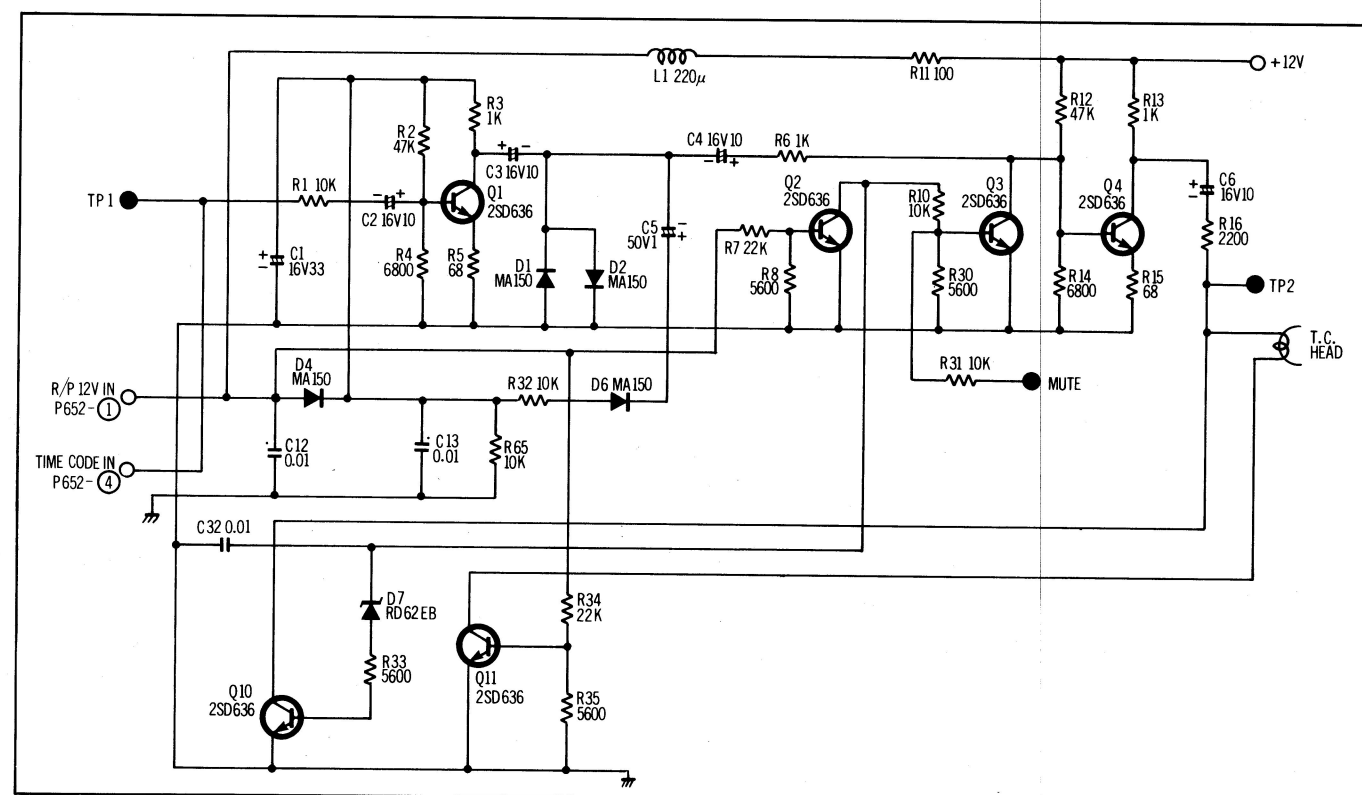


Figure 2-221

In either play or record, the signal is sent to Q14 and to Q5. Q14 amplifies the T.C. signal so D10, D11 can clip and shape it for the output stage Q16, Q17. Q15 is a mute, driven by the time code sense circuit, as was Q3. See Figure 2-223.

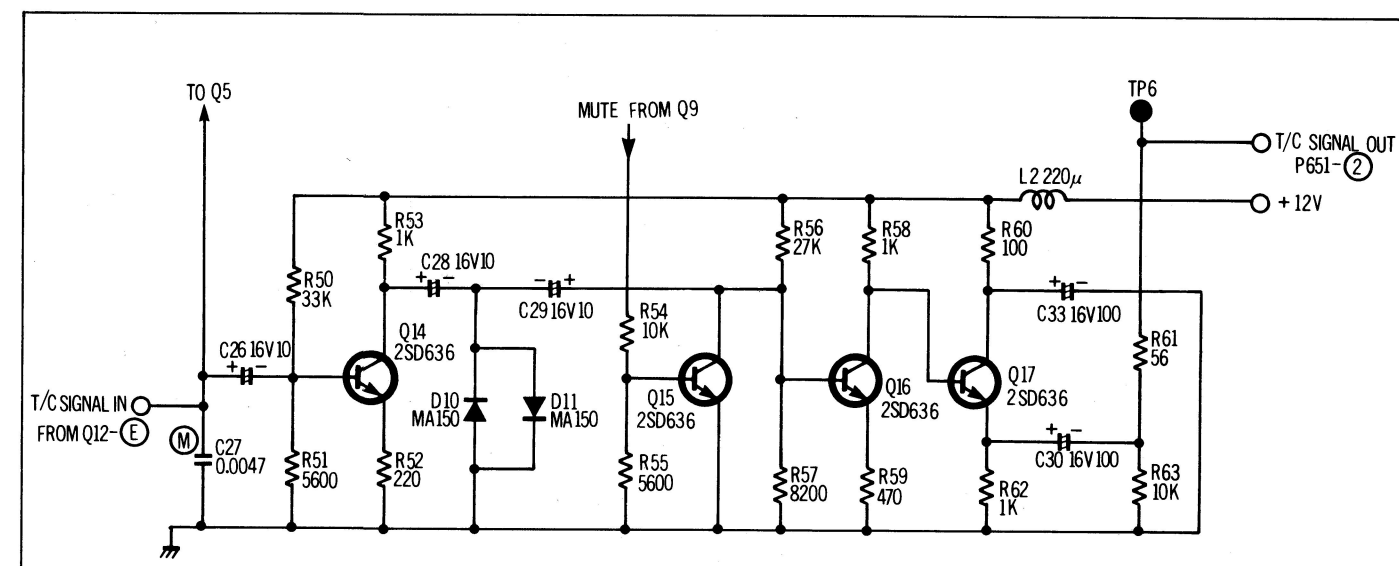


Figure 2-223

The signal at Q5 is amplified to turn Q6 on and off, which keeps C10 discharged, which in turn keeps Q7 off and Q9 on. This lights the T.C. Lamp and disables the two mute transistors Q3, Q15. Q8 is slow turn on at application of power to prevent false indication at the T.C. Lamp and mute. See Figure 2-224.

The time code circuit is enabled by a switch on the rear panel, S6306. This switches +12 from the Audio Ch 1 meter lamp to the time code +12 line that provides +12 to the T.C lamp, mutes the Audio CH1 signal circuit, and inputs to the MPU (System Control) that Time Code has been selected.

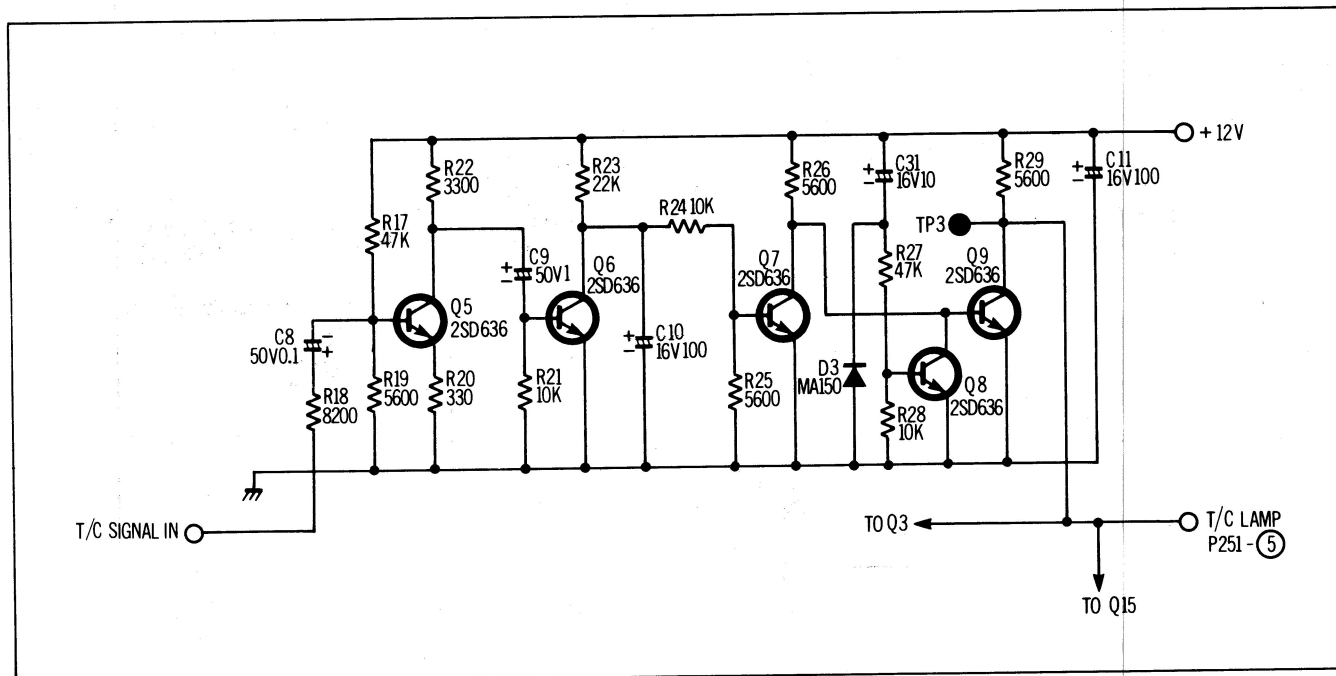


Figure 2-224

FEATURES

1. Programmed Editing

The AU-A70 is complete with a built in SMPTE Time Code Generator and Reader. The Location and storage of editing points can be done by operating the keyboard. Time code can be recorded on tapes and up to a maximum of 20 program segments edits may be stored and recalled as a continuous sequence.

2. With Search Dial

By the use of the search dial and observation of the picture monitor editing points may be chosen and locations stored continuously up to maximum 20 program segments with time code.

3. Ease of operation

Feather-touch non-locking push buttons with logic memory controls give full remote control capability.

4. 2 playback units may be used

With the multiple source adaptor AU-J10 an optional accessory, 2 playback units can be controlled. And, by using the simultaneous start of the AU-A70, it is also possible to find the beginnings of two tapes recorded simultaneously, making editing possibilities even more sophisticated. (So called "film technique" or "A/B roll" editing.)

5. Error indication

A mistake in editing procedure is indicated by the symbol "EE" in the Counter Display of the playback unit. The incorrect portion is shown by a numeric code for operator assistance.

6. Light Emitting Diode (LED) frame-counter display

Frames are counted by a recorded control signal on the tape, and the tape position is clearly shown by the Counter Display.

7. Variety of editing modes

Insert and assemble-editing of video, and two audio channels for insert-editing, offer a combination of editing capabilities.

8. Servo-lock indicator

A lamp indicates that the video servo circuitry has stabilized.

9. Lap-time indicator

The counter display indicates, by the number of frames, the time required from the beginning to the end of editing.

10. Revision of editing points

By pressing down Field-Advance (plus/minus) button, the editing point can be revised field by field. (Only for use with AU-700.)

11. Preview editing

A rehearsal of the intended edit point, before actual recording, allows accurate judgment of the finished effect prior to performance of the actual edit.

12. Editing review

A review of the edited portion, from the point five seconds before the edit to the point one second after, is possible by using the REVIEW mode. Following the review, the tape automatically returns to the final edit point and remains ready for the next edit.

13. Tape protection

If the unit is left in the PAUSE mode for more than approximately ten minutes, it automatically switches to the STOP mode in order to prevent damage to the tape.

14. Editing of video camera signals

A wide variety of audio and video editing functions are possible if a video camera is connected.

Editing Controller AU-A70

SPECIFICATIONS

Power Source: AC 100/120/220/240 V (Selectable), 50/60 Hz

Power Consumption: Approx. 65 W

Controls:

Playback-Unit Side: Record [REC], playback unit-1 [VTR 1], playback unit-2 [VTR 2], line [LINE]

Editor-Unit Side: Record [REC], edit [EDIT], cut-in [CUT IN], cut-out [CUT OUT]

Playback-Unit/Editor-Unit: Fast-forward [FF], playback [PLAY], rewind [REW], stop [STOP], pause [PAUSE], search [SEARCH], Step-Advance Plus [+], Step-Advance Minus [-], Search Dial

Editing Controls:

Editing Models: Assembly [ASSY], insert [CH1, CH2, VIDEO]

Editing Reference: Playback-unit reference [SOURCE], editor-unit reference [EDITOR]

Program Keyboard: Program number [PROGRAM], check [CHECK], source [SOURCE], editor [EDITOR], exchange [EXCHANGE], insert [INSERT], time-shift plus [+], time-shift minus [-] numeric keyboard

Control Names: Preview [PREVIEW], edit start [EDIT START], edit stop [EDIT STOP], review [REVIEW], return [RETURN], go-to [GO TO]

Edit Point Entry: Entry [ENTRY], reset [RESET], exit [EXIT]

Time-Code Entry Controls: Time-code reset [RESET], Time-code start [START], Time-code hold [HOLD]

Counter Display:

Time Indication: Maximum ± 9 hr. 59 min. 59 sec. 29 frames [both (playback/editor) units]

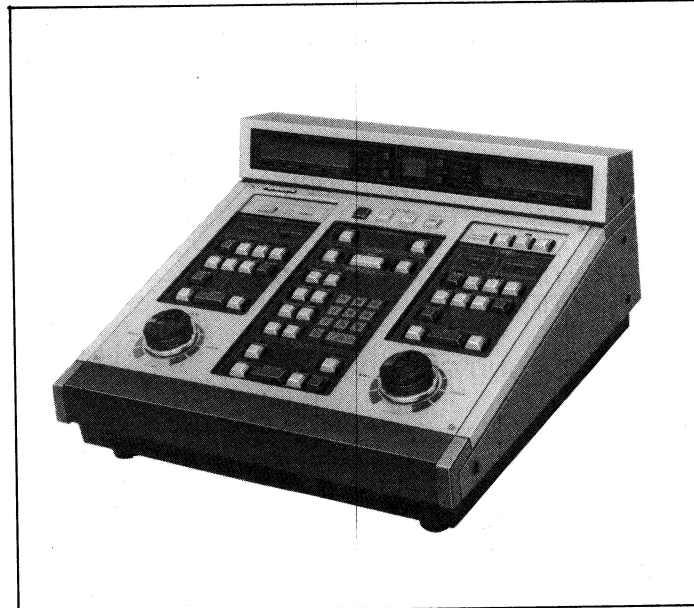
Lap-Time Indication: Maximum ± 9 hr. 59 min. 59 sec. 29 frames [both (playback/editor) units]

Counter display selection: Entry time indication/exit time indication, time indication/lap time indication

Edit Number Display:

Edit Number Indication: Maximum 99

Programmable Edit Number Indication: Maximum 20 pre-programmed edits



Compatible VTR units: Basic system: AU-700, NV-9600, NV-9240
Limited system: NV-9500(A), NV-9200(A), NV-8200, NV-8170

Connection Capability
(no of Units): Source: 2 Playback unit, 1 line
Editor: 1 Editor unit

Connectors:

Power Terminal: 3-pin connector

Remote-Control Terminal: 34-pin Remote control cable connector (playback unit-1/playback unit-2/editor unit/multiple source adaptor)

Input: Sync input: BNC connector (multiple source adaptor), 4.0 Vp-p negative pulse, 75 Ω unbalanced
Time code: RCA pin jack [both, (playback unit-1/editor)], more than 1.0 Vp-p, High Impedance

Output: Time code: RCA pin jack [both, (playback unit-1/editor)], 3.0 Vp-p, Low Impedance

Editing Precision: ± 2 frames (used with AU-700/NV-9600/NV-9240)

Operating

Temperature: 41°F ~ 104°F (5°C ~ 40°C)

Operating Humidity: 35% ~ 80%

Weight: 31.9 lbs. (14.5 kg)

Dimensions: 17-1/8" (W) $\times$ 9-1/4" (H) $\times$ 17" (D)
432(W) $\times$ 233(H) $\times$ 430(D) mm

Standard Accessories
(Included): 1 pc. AC power cord, VJA0129
2 pcs. 34-pin Remote control cables, VJA0149, Approx. 16.4 ft (5 m)
1 pc. Dust cover, VFB0003

Weight and dimensions shown are approximate.
Specifications are subject to change without notice.

PRECAUTIONS

OPERATION NOTES

Note the following information prior to playing the AU-A70 Editing Controller in operation with a video cassette recorders.

■ When the power of the AU-A70 Editing Controller is on:

Select the editing mode using this unit. In any mode other than editing, both editing controller and video cassette recorders can be operated. Neither will have priority of operation except for the Stop Button of the video cassette recorder. If the unit has not function as you desire, press the Edit Stop Button and begin again.

■ Do not cover the ventilation holes.

In order to provide proper ventilation, there are ventilation holes on the bottom and back of this unit. Leave more than 15 cm of space between the back of the unit and any surfaces (wall, etc.), and more than 5 cm of space on each side. Do not cover these by placing the unit on a carpet or other soft material.

■ Use this unit horizontally and do not place anything on the top panel.

■ This unit is supplied with a 3-prong grounded AC plug-do not try to defeat its purpose.

■ When the power of the AU-A70 Editing Controller is off:

If a video cassette recorder is connected, it can be operated independently of this unit.

■ If the power source is turned off or the power is otherwise interrupted, the editing memory will be completely erased. Editing will then have to be redone.

■ Do not spray any cleaner or wax directly on the unit.

■ If the unit is not going to be used for a length of time, protect it from dirt and dust by using the dust cover.

■ Do not attempt to disassemble the controller.

There are no user serviceable parts inside.

■ If any liquid spills inside the controller, have the controller examined for possible damage.

■ Refer any needed servicing to qualified service personnel.

■ Please read the attached warranty card completely.

■ VOLTAGE ADJUSTMENT

To adjust the voltage selector, turn the voltage selector with a screwdriver.

CAUTION: Operation at a voltage setting higher than 125 V AC may require the use of a different AC plug or cord set. Please contact either a local or foreign Panasonic authorized service center for assistance in selecting an alternate AC plug or cord set.

VOLTAGE SELECT	SETTING THE VOLTAGE SELECTOR				
	LOCAL VOLTAGE	AC 100V	AC 120V	AC 220V	AC 240V

WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE.

MAJOR OPERATING COMPONENTS

TOP

PLAYBACK UNIT COUNTER DISPLAY
(See page 161.)

EDIT NUMBER DISPLAY
(See page 162.)

EDITOR UNIT COUNTER DISPLAY
(See page 162.)

POWER SWITCH
(See page 163.)

PLAYBACK UNIT CONTROLS
(See page 163.)

TIME-CODE ENTRY
CONTROLS (See page 164.)

EDITOR UNIT CONTROLS
(See page 164.)

MAIN EDITING CONTROLS
(See pages 165 and 166.)

REAR

MULTIPLE-SOURCE ADAPTOR
CONNECTION TERMINALS (See page 167.)

EDITOR UNIT CONNECTION
TERMINALS (See page 167.)

PLAYBACK UNIT-2 CONNECTION TERMINALS
(See page 169.)

PLAYBACK UNIT-1 CONNECTION TERMINALS
(See page 169.)

VENTILATION HOLE
(See page 168.)

VOLTAGE SELECTOR
(See page 168.)

POWER-CODE SOCKET
(See page 168.)

AUXILIARY TIME-CODE CONNECTION
TERMINALS (See page 168.)

CONTROLS AND THEIR FUNCTIONS

TOP

PLAYBACK UNIT COUNTER DISPLAY

① RESET BUTTON [RESET]

② TIME INDICATOR LAMP [TIME]

③ ENTRY-TIME INDICATION LAMP
[ENTRY TIME]

④ PLAYBACK UNIT COUNTER-
DISPLAY

⑤ EXIT-TIME INDICATION LAMP [EXIT TIME]

⑥ LAP-TIME INDICATOR LAMP [LAP TIME]

⑦ LAP-TIME BUTTON [LAP TIME]

⑧ EDIT NUMBER DISPLAY [EDIT NO.]

EDITOR UNIT COUNTER DISPLAY

⑨ RESET BUTTON [RESET]

⑩ TIME INDICATOR LAMP [TIME]

⑪ ENTRY-TIME INDICATION LAMP
[ENTRY TIME]

⑫ EDITOR UNIT COUNTER DISPLAY

⑬ EXIT-TIME INDICATION LAMP [EXIT TIME]

⑭ LAP-TIME INDICATOR LAMP [LAP TIME]

⑮ LAP-TIME BUTTON [LAP TIME]

① **RESET BUTTON [RESET]**
Pressing this button resets the Playback Unit Counter Display to "0".

② **TIME INDICATOR LAMP [TIME]**
When this lamp is illuminated, the Playback Unit Counter Display is indicating the time.

③ **ENTRY-TIME INDICATION LAMP [ENTRY TIME]**
●Pressing the Entry Button to make an entry of edit-start point on the playback unit side, will cause this lamp to illuminate.
●When the time-code preprogrammed edits are entered, check the editing program by pressing the Check Button. When this lamp illuminates, the playback unit counter display shows the edit-start point.

④ **PLAYBACK UNIT COUNTER DISPLAY**
The counter display for the playback unit can show the following 5 indications:
●Time Indication
When the edit number display shows "0" indication, it will indicate the position of the tape from the point where the cassette tape was inserted or where the Reset Button was pressed.
When in the time-code signal mode, it will indicate the absolute address of the tape.
●Lap-Time Indication
Indicates the "lap time" (the time necessary for the edit), measured from the point at which the Entry Button was pressed.

●Entry-Time Indication
This indicates the edit-start point programmed by pressing the Entry Button.
●Exit-Time Indication
This indicates the edit-stop point programmed when the Exit Button was pressed.
●Error Indication
When any error in the editing process has been made, it will indicate "EE", which means mistake has been made in operation. (See page 228.)

⑤ **EXIT-TIME INDICATION LAMP [EXIT TIME]**
●Pressing the Exit Button to make an entry of the edit-end point on the playback unit side will cause this lamp to illuminate.
●When time-code preprogrammed edits have been entered, check the editing program by pressing the Check Button. When this lamp illuminates, the playback unit counter display will show the edit-end point.
When the playback unit counter display shows "0" indication, the edit reference is on the editor unit side.

⑥ **LAP-TIME INDICATOR LAMP [LAP TIME]**
When this lamp illuminates, the playback unit counter display will show the lap time.

⑦ **LAP-TIME BUTTON [LAP TIME]**
This button is used to initiate the lap time mode.

⑧ EDIT NUMBER DISPLAY [EDIT NO.]

This display shows the number of the edit to be programmed. Check or performed.
When the control signal editing mode is selected, this display shows "0".

⑨ RESET BUTTON [RESET]

Pressing this button resets the indicator of the Editor Unit Counter Display is to "0".

⑩ TIME INDICATOR LAMP [TIME]

When this lamp is illuminated, the Editor Unit Counter Display is indicating the time.

⑪ ENTRY-TIME INDICATION LAMP [ENTRY TIME]

- Pressing the Entry Button to make an entry of edit-start point on the editor unit side will cause this lamp to illuminate.
- When the time-code preprogrammed edits are entered, check the editing program by pressing the Check Button. When this lamp illuminates, the editor unit counter display shows the edit-start point.

⑫ EDITOR UNIT COUNTER DISPLAY

The counter display for the editor unit can show the following 4 indications:

● Time Indication

When the edit number display shows "0" indication, it will indicate the position of the tape from the point where the cassette tape was inserted or where the Reset Button was pressed.

When in the time-code signal mode, it will indicate the absolute address of the tape.

● Lap Time Indication

Indicates the "lap time" (the time necessary for the edit), measured from the point at which the Entry Button was pressed.

● Entry-Time Indication

This indicates the edit-start point programmed by pressing the Entry Button.

● Exit-Time Indication

This indicates the edit-stop point programmed when the Exit Button was pressed.

⑬ EXIT-TIME INDICATION LAMP [EXIT TIME]

- Pressing the Exit Button to make an entry of the edit-end point on the editor unit side will cause this lamp to illuminate.
- When time-code preprogrammed edits have been entered, check the editing program by pressing the Check Button. When this lamp illuminates, the editor unit counter display will show the edit-end point.
When the editor unit counter display shows "0" indication, the editing reference is on the playback unit side.

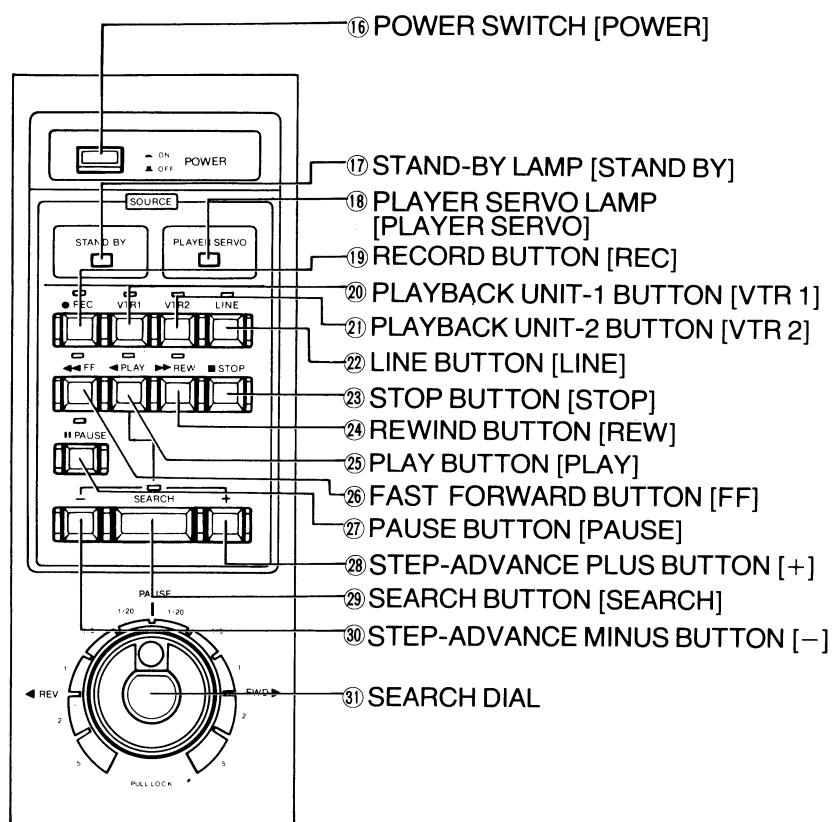
⑭ LAP-TIME INDICATOR LAMP [LAP TIME]

When this lamp illuminates, the editor unit counter display will show the lap time.

⑮ LAP-TIME BUTTON [LAP TIME]

This button is used to initiate the lap time.

POWER SWITCH, PLAYBACK UNIT CONTROLS



16 POWER SWITCH [POWER]

When the Power Switch is first turned on, the Time-Indication Lamp of the Playback and Editor Unit sides illuminate and both Counter Displays and the Edit Number Display show "0" indication. VTR 1, Insert Mode (CH 1 CH 2 VIDEO) Button, and the Editor Lamp of the reference will be lit. Note that, when the Power Switch is turned off, the memory of this unit is completely erased.

17 STAND-BY LAMP [STAND BY]

This lamp will illuminate while the tape is being loaded or unloaded in the playback unit.

18 PLAYER SERVO LAMP [PLAYER SERVO]

This lamp illuminates to indicate that the servo circuitry in the playback unit has stabilized.

Before editing, make certain that this lamp is illuminated.

19 RECORD BUTTON [REC]

Press this button and the Play Button at the same time to begin audio/video recording.

20 PLAYBACK UNIT-1 BUTTON [VTR 1]

Press this button to select the playback unit connected to the Playback Unit-1 Connector.

21 PLAYBACK UNIT-2 BUTTON [VTR 2]

Press this button to select the playback unit connected to the Playback Unit-2 Connector.

22 LINE BUTTON [LINE]

Press this button when the edit is to be made from a real time source such as a video camera or audio equipment.

23 STOP BUTTON [STOP]

When this button is pressed, all operations of the playback unit stop.

24 REWIND BUTTON [REW]

This button is used to rapidly rewind the tape.

25 PLAY BUTTON [PLAY]

This button is used to begin playback of a recorded tape.

26 FAST FORWARD BUTTON [FF]

This button is used to rapidly advance the tape.

27 PAUSE BUTTON [PAUSE]

This button is used to temporarily stop the tape. When it is pressed, the tape stops and the Pause Lamp illuminates. When it is pressed again, playback resumes and the Pause Lamp extinguishes.

28 STEP-ADVANCE PLUS BUTTON [+]

When this button is pressed in the pause mode during the search operation, the picture on the TV monitor will advance one field each time.

29 SEARCH BUTTON [SEARCH]

This button is used to enable operation of the search dial.

It will operate only in the playback mode. After pressing this button, use the Search Dial to find the desired point.

30 STEP-ADVANCE MINUS BUTTON [-]

When this button is pressed in the pause mode during the search operation, the picture on the TV monitor will return one field each time.

31 SEARCH DIAL

This dial is used to shift the tape position to locate or examine program material.

It is used in either the forward [FWD] or reverse [REV] mode to temporarily stop the tape or operate it at one of the following five speeds: normal playback speed, 1/20× normal playback speed, 1/5× normal playback speed, 2× normal playback speed, and 5× normal playback speed.

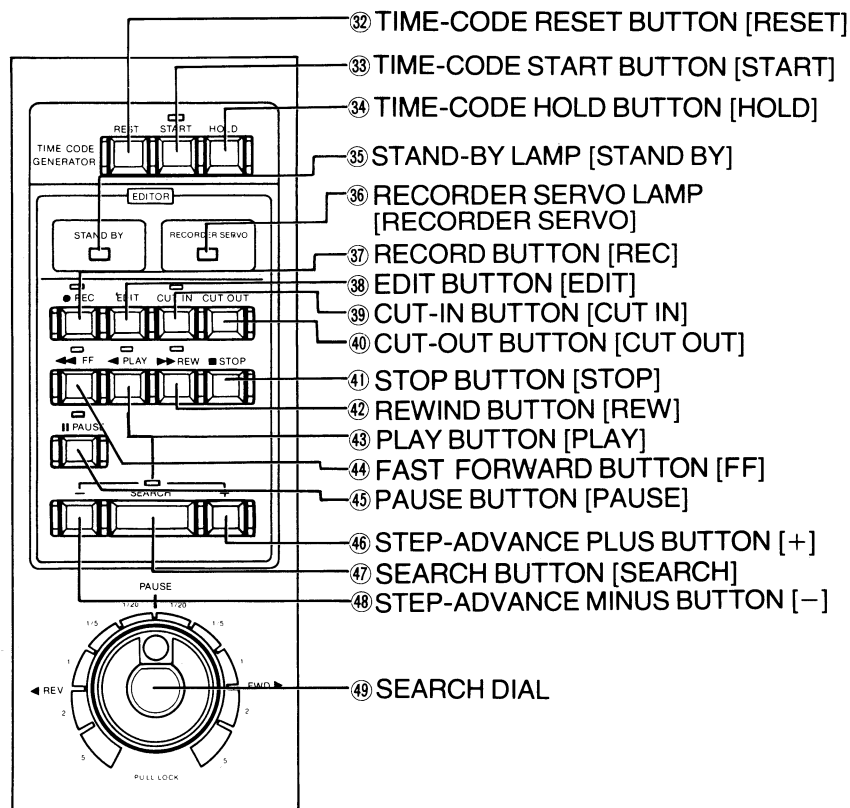
When the dial is released, it normally automatically returns to the pause position.

In order to lock the dial in one position, pull it outward [PULL LOCK]. In order to release the lock, push the dial in.

Note:

Make certain that the Play Button and the Search Button are both pressed, by checking the lamps. After confirming that the lamps are illuminated, proceed to turn the Search Dial slowly to the desired speed and direction.

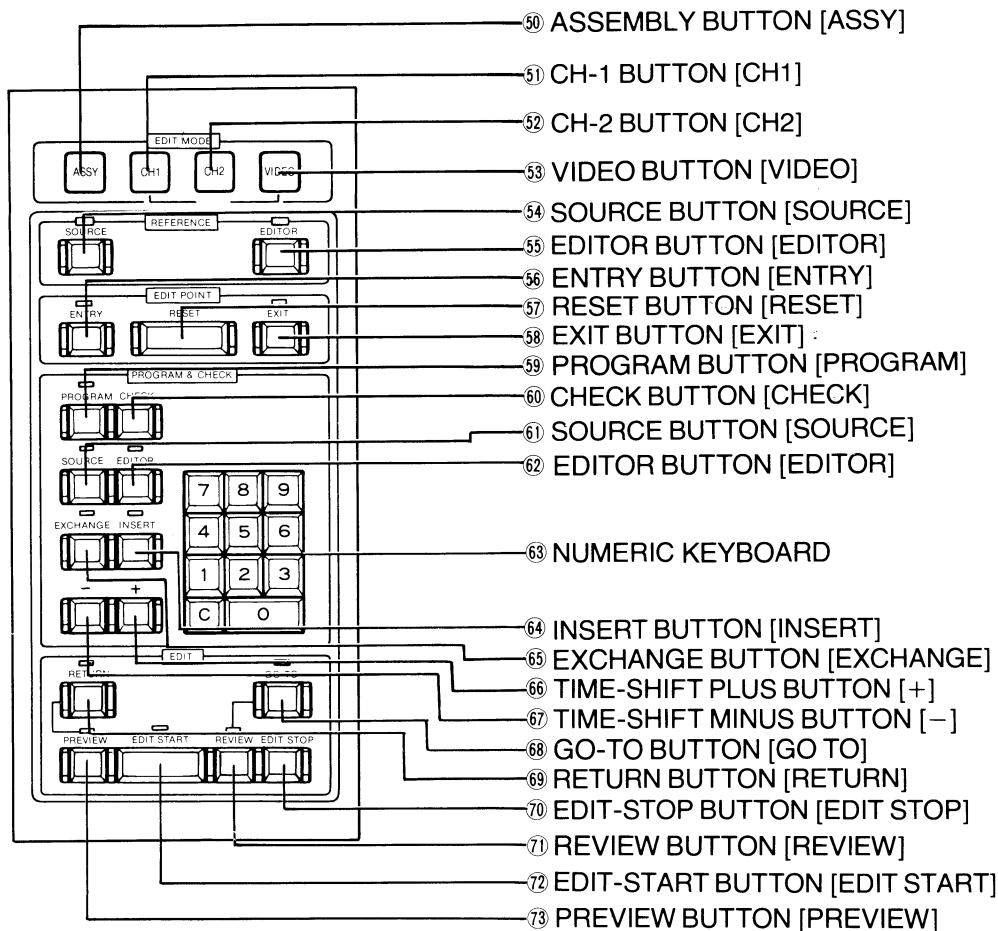
TIME-CODE GENERATOR AND EDITOR UNIT CONTROLS



- ③② **TIME-CODE RESET BUTTON [RESET]**
When this button is pressed, the time-code generator will be reset.
- ③③ **TIME-CODE START BUTTON [START]**
When this button is pressed, the time-code will be simultaneously sent to the connected playback unit and editor unit.
- ③④ **TIME-CODE HOLD BUTTON [HOLD]**
When this button is pressed, the sending of the time-code will be stopped.
- ③⑤ **STAND-BY LAMP [STAND BY]**
This lamp will illuminate while the tape is being loaded or unloaded in the editor unit.
- ③⑥ **RECORDER SERVO LAMP [RECORDER SERVO]**
This lamp illuminates to indicate that the servo circuitry in the editor unit has stabilized. Before editing, make certain that this lamp is illuminated.
- ③⑦ **RECORD BUTTON [REC]**
This button and the Play Button must be pressed simultaneously to begin audio/video recording.
- ③⑧ **EDIT BUTTON [EDIT]**
This button is used for manual insert-editing or assemble-editing.
- ③⑨ **CUT-IN BUTTON [CUT IN]**
This button is used when beginning an insert-edit or to monitor signals to be recorded.

- ④① **CUT-OUT BUTTON [CUT OUT]**
Press this button when manual insert-editing is completed.
- ④② **STOP BUTTON [STOP]**
This button is used to stop all operation of the editor unit.
- ④③ **REWIND BUTTON [REW]**
This button is used to rapidly rewind the tape.
- ④④ **PLAY BUTTON [PLAY]**
This button is used to playback a recorded tape.
- ④⑤ **FAST FORWARD BUTTON [FF]**
This button is used to rapidly advance the tape.
- ④⑥ **PAUSE BUTTON [PAUSE]**
This button is used to temporarily stop the movement of the tape. When this button is pressed, the tape movement stops and the Pause Lamp illuminates. When it is pressed a second time, the playback resumes and the Pause Lamp is no longer illuminated.
- ④⑦ **STEP-ADVANCE PLUS BUTTON [+]**
When this button is pressed in the pause mode during the search operation, the picture on the TV monitor will advance one field each time.
- ④⑧ **SEARCH BUTTON [SEARCH]**
This button is used to enable operation of the search dial. It operates only in the playback mode. After pressing this button, use the Search Dial to locate the desired point.
- ④⑨ **STEP-ADVANCE MINUS BUTTON [-]**
When this button is pressed in the pause mode during the search operation, the picture on the TV monitor will return one field each time.
- ④⑩ **SEARCH DIAL**
This dial is used to shift the tape position to locate or examine program material. It is used in either the forward [FWD] or reverse [REV] mode to temporarily stop the tape or operate it at one of the following five speeds: normal playback speed, 1/20× normal playback speed, 1/5× normal playback speed, 2× normal playback speed, and 5× normal playback speed.
When the dial is released, it normally automatically returns to the pause position. In order to lock the dial in one position, pull it outward [PULL LOCK]. In order to release the lock, push the dial in.
Note:
Make certain that the Play Button and the Search Button are both pressed by checking the lamps. After confirming that the lamps are illuminated, proceed to turn the Search Dial slowly to the desired speed and direction.

MAIN EDITING CONTROLS



50 ASSEMBLY BUTTON [ASSY]

This button is used to select assembly editing. It will cancel the insert Select (51, 52, 53) below.

51 CH-1 BUTTON [CH1]

This button is used to select audio channel 1 for insert-editing.

52 CH-2 BUTTON [CH2]

This button is used to select audio channel 2 for insert-editing.

53 VIDEO BUTTON [VIDEO]

This button is used to select the video signal for insert-editing.

54 SOURCE BUTTON [SOURCE]

If the lamp of this button illuminates, the playback unit will be the reference for edit points. This button is mutually exclusive with (55) Editor Button below in the insert edit mode, and is always on for assembly editing.

55 EDITOR BUTTON [EDITOR]

If the lamp of this button illuminates, the editor unit will be the reference for edit points. This button is mutually exclusive with (54) above in the insert mode, and is disabled in the assembly mode.

56 ENTRY BUTTON [ENTRY]

This button is used to enter the starting point of an edit.

57 RESET BUTTON [RESET]

This button is used when an entered edit point is to be changed.

58 EXIT BUTTON [EXIT]

This button is used to enter the end point of an edit.

59 PROGRAM BUTTON [PROGRAM]

Press this button for programmed editing. This button should also be used for programmed edit checking to change the program order, or to insert a program between already entered points.

⑥0 CHECK BUTTON [CHECK]

Press this button to check the entered editing program or for correction of the program edit.

⑥1 SOURCE BUTTON [SOURCE]

Press this button to select the playback unit.

⑥2 EDITOR BUTTON [EDITOR]

Press this button to select the editor unit.

⑥3 NUMERIC KEYBOARD

Press those buttons to enter the program number or the time-code.

Note:

Press the clear "C" Button to erase the program number or the time-code.

⑥4 INSERT BUTTON [INSERT]

Press this button to insert an edit between entered programmed edits.

⑥5 EXCHANGE BUTTON [EXCHANGE]

Press this button to exchange the order of two edit programs.

⑥6 TIME-SHIFT PLUS BUTTON [+]

Press this button when the time-code is to be corrected. The time-code shown on the Counter Display will increase by one frame each time this button is pressed.

Note:

To correct, be sure to check if Source Lamp ⑥1 or Editor Lamp ⑥2 illuminates (as well as Playback Unit 1, Unit 2 or Line). Then proceed with the correction of the time-code of VTR.

⑥7 TIME-SHIFT MINUS BUTTON [-]

Press this button when the time-code is to be corrected. The time-code shown on the Counter Display will decrease by one frame each time this button is pressed.

Note:

To correct, be sure to check if Source Lamp ⑥1 or Editor Lamp ⑥2 illuminates (as well as Playback Unit 1, Unit 2 or Line). Then proceed with the correction of the time-code of VTR.

⑥8 GO-TO BUTTON [GO TO]

This is used to advance the tape to the end point of an edit or search the specific time-code address.

⑥9 RETURN BUTTON [RETURN]

This button is used to return the tape to the starting point of an edit.

⑦0 EDIT-STOP BUTTON [EDIT STOP]

This button is used at the end of an edit. The point at which this button is pressed becomes the edit end point, and the editing stops.

⑦1 REVIEW BUTTON [REVIEW]

This button is used, after the edit has been finished, in order to confirm that the edited portion has been edited as desired.

⑦2 EDIT-START BUTTON [EDIT START]

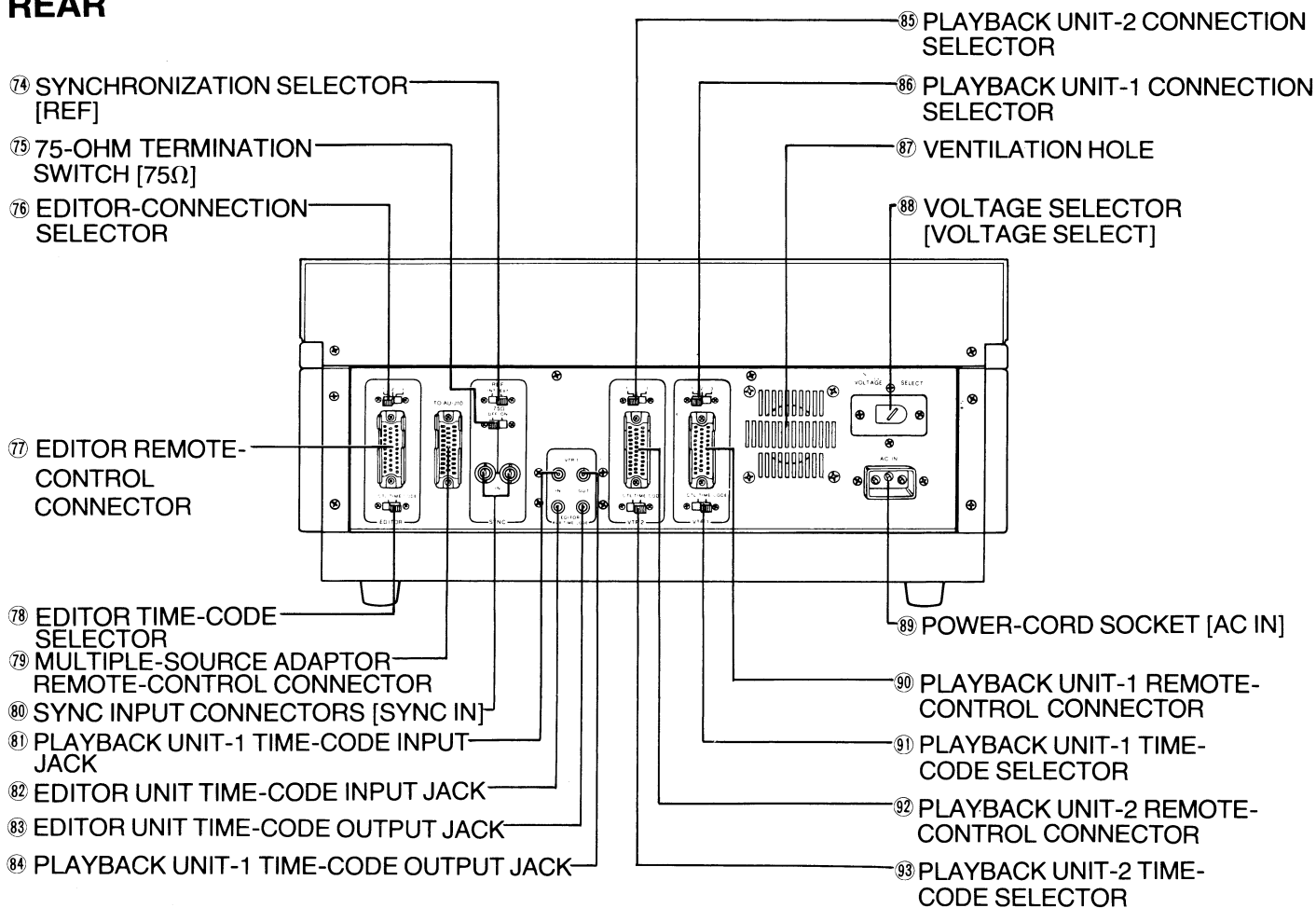
This button is used to make the actual edit.

When this button and the Preview Button are pressed at the same time, the edit will begin.

⑦3 PREVIEW BUTTON [PREVIEW]

This button is used to preview an edit before the edit is made.

REAR



74 SYNCHRONIZATION SELECTOR [REF]

This switch selects the synchronization signal to be used.

INT: To synchronize the tape with the internal 60 Hz oscillator.

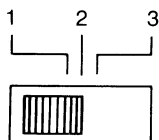
EXT: To synchronize the tape with the external composite sync which is connected to the Sync Input Connector.

75 75-OHM TERMINATION SWITCH [75Ω]

Set this switch to the "ON" position in order to terminate the external composite synch signal. At other times, set it to the "OFF" position.

76 EDITOR-CONNECTION SELECTOR

Set this switch to the position corresponding to the type of video recorder connected to the Editor Remote-Control Connector. (Refer to the figure below.)



VTR 1: 3/4 VCR	AU-700 NV-9600 NV-9240
VTR 2: 3/4 VCR	NV-9500A NV-9200A
VTR 3: VHS	NV-8200 NV-8170

● If connected VTR 2/VTR 3 video recorder as the editor unit, editing function is limited.

77 EDITOR REMOTE-CONTROL CONNECTOR

Connect this terminal and the Remote-Control Connector of the Editor using a 34-pin remote-control connection cable.

78 EDITOR TIME-CODE SELECTOR

This switch has two positions: "CTL" for selection of the control signal, and "TIME CODE" for selection of the time-code signal.

79 MULTIPLE-SOURCE ADAPTOR REMOTE-CONTROL CONNECTOR

If the AU-J10 multiple-source adaptor is to be used, connect this terminal and the AU-A70 Connection Terminal of the AU-J10.

80 SYNCHRONIZATION-INPUT CONNECTORS [SYNC IN]

If an external reference synchronization signal is to be utilized connect the composite synch signal here.

⑧1 PLAYBACK UNIT-1 TIME-CODE INPUT JACK

This terminal is used if time-code will be used for program editing. Connect this terminal to the Time-Code Output Terminal of playback unit-1.

⑧2 EDITOR UNIT TIME-CODE INPUT JACK

This terminal is used if time-code will be used for program editing. Connect this terminal to the Time-Code Output Terminal of the editor.

⑧3 EDITOR UNIT TIME-CODE OUTPUT JACK

This is the terminal for output of the time-code signals. Connect this terminal to the Time-Code Input Terminal of the editor.

⑧4 PLAYBACK UNIT-1 TIME-CODE OUTPUT JACK

This is the terminal for output of the time-code signals. Connect this terminal to the Time-Code Input Terminal of playback unit-1.

⑧5 PLAYBACK UNIT-2 CONNECTION SELECTOR

Set this switch to the position corresponding to the type of video recorder connected to the Playback Unit-2 Remote-Control Connector.
(Refer to the illustration for ⑦6.)

⑧6 PLAYBACK UNIT-1 CONNECTION SELECTOR

Set this switch to the position corresponding to the type of video recorder connected to the Playback Unit-1 Remote-Control Connector.
(Refer to the illustration for ⑦6.)

⑧7 VENTILATION HOLE

This is the air outlet hole for the ventilation fan.

⑧8 VOLTAGE SELECTOR [VOLTAGE SELECT]

Four voltages are available for selection: 100 V, 120 V, 220 V and 240 V. To set to any voltage setting other than 120 V, consult page 2.

⑧9 POWER-CORD SOCKET [AC IN]

This is the power source for the controller. Make the connection from here to the AC mains.

⑨0 PLAYBACK UNIT-1 REMOTE-CONTROL CONNECTOR

Connect this terminal to the Remote-Control Connector of Playback Unit-1 using a 34-pin remote-control connection cable.

⑨1 PLAYBACK UNIT-1 TIME-CODE SELECTOR

This switch has two positions:
“CTL” for selection of the control signal, and “TIME CODE” for selection of the time-code signal.

⑨2 PLAYBACK UNIT-2 REMOTE-CONTROL CONNECTOR

Connect this terminal to the Remote-Control Connector of Playback Unit-2 using a 34-pin remote-control connection cable.

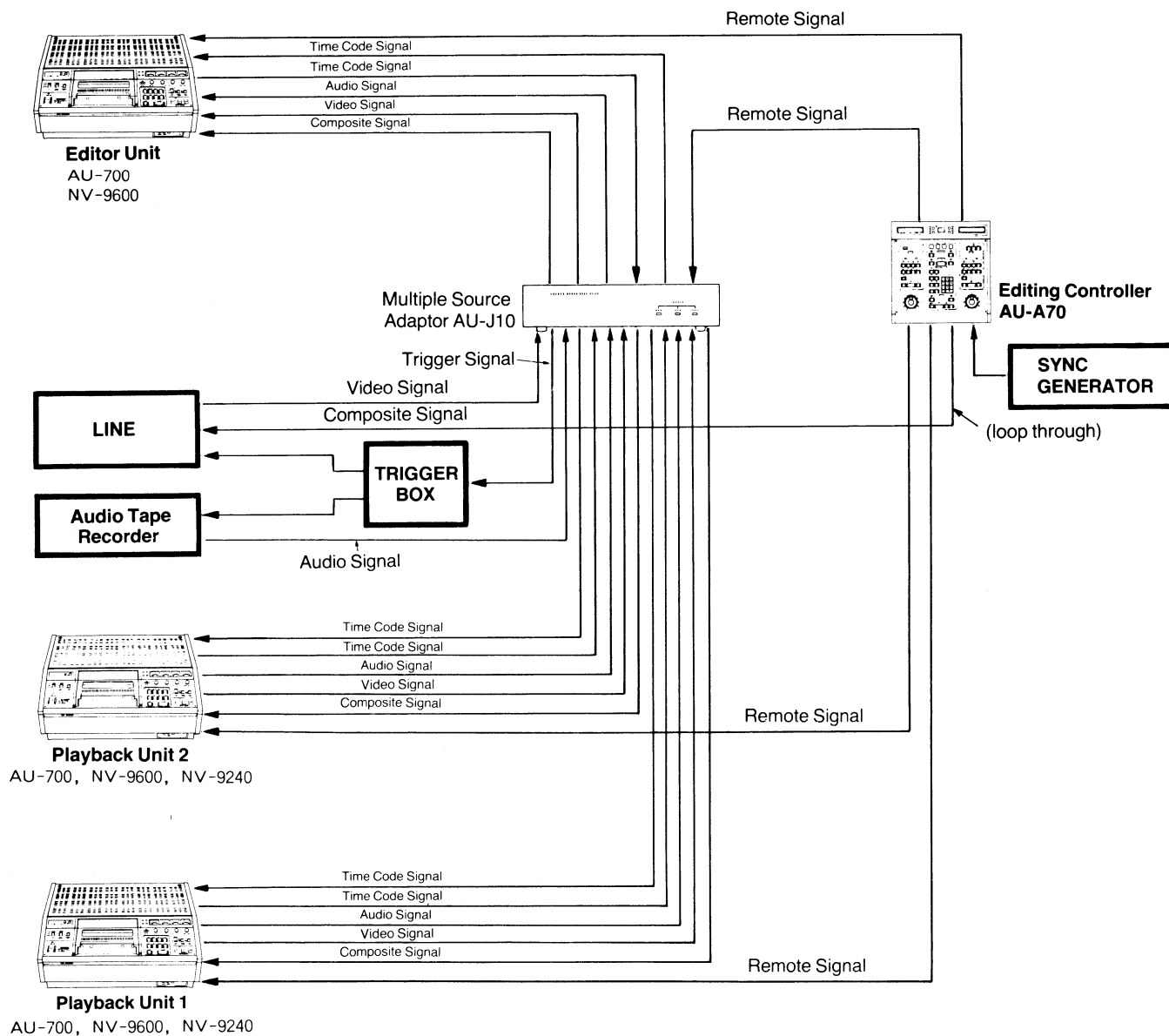
⑨3 PLAYBACK UNIT-2 TIME-CODE SELECTOR

This switch has two positions:
“CTL” for selection of the control signal, and “TIME CODE” for selection of the time-code signal.

EDITING SYSTEM INCLUDING THE AU-J10 MULTIPLE-SOURCE ADAPTOR

The AU-J10 can be used in various ways within the editing system, as shown below, depending upon requirements of use.

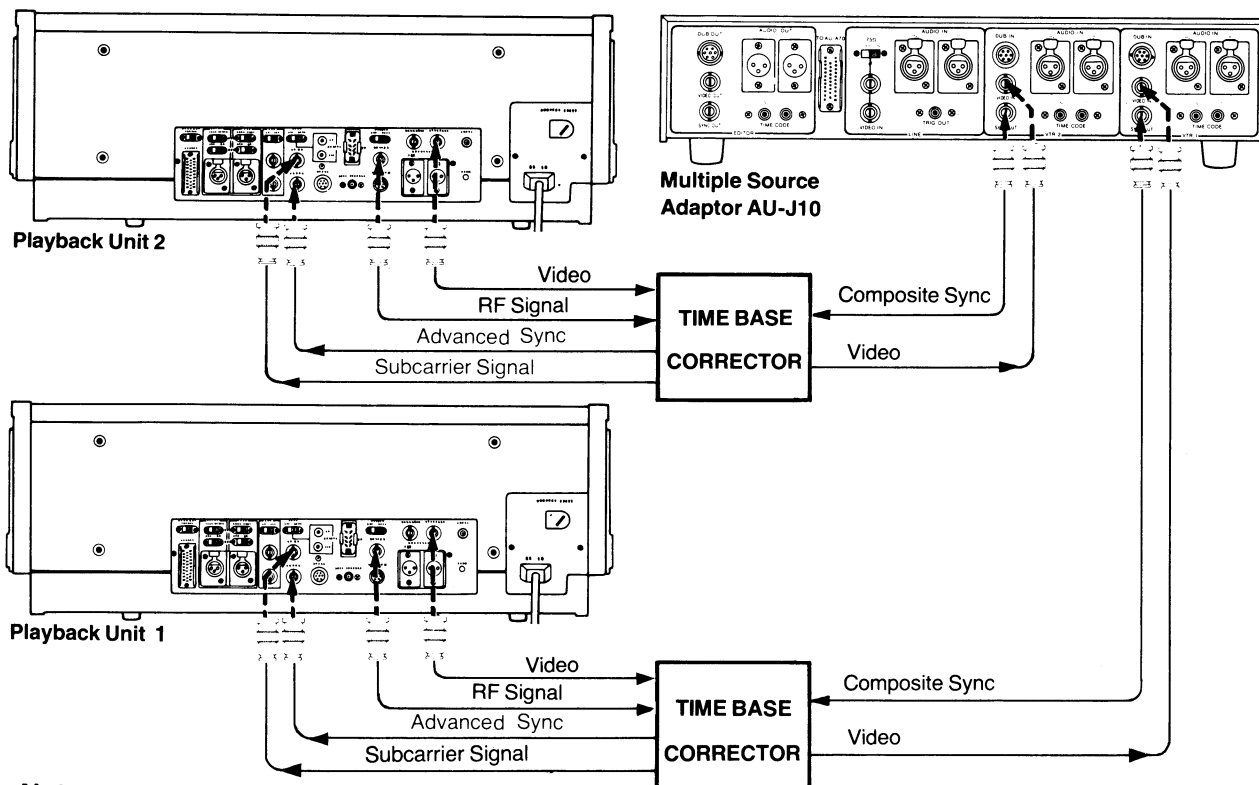
■ EDITING SYSTEM



■ TIME BASE CORRECTOR

If a Time-Base Corrector (TBC) is to be utilized, (ordinarily available commercially from others), make the connections as shown in the figure below.

The video signal, the composite synchronization signal, the RF signal and the subcarrier signal should be connected. Also consult the instruction manual for the TBC.

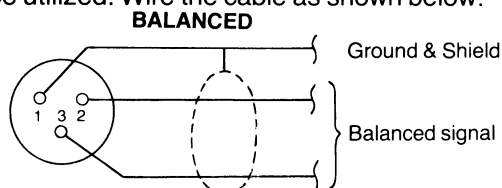


Note:

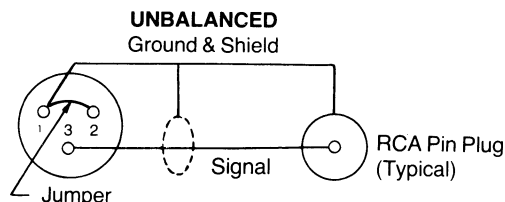
- Use the BNC-type connector for the cable for the video signal.

■ AUDIO CONNECTOR ADAPTATION

The AU-A70 is designed to function with either the AU-700 recorder or the NV-9240/9600 units. Since the AU-700 is equipped with balanced audio and XLR type connectors, the AU-A70 is also equipped with XLR connectors. For connection to a different recorder or other unbalanced audio device, an adaptor cable must be utilized. Wire the cable as shown below.



NOTE: In order to assure proper audio phase, wire all connectors identically.



NOTE: Pins 1 and 3 rather than 1 and 2 may be made common if this is the user's convention.

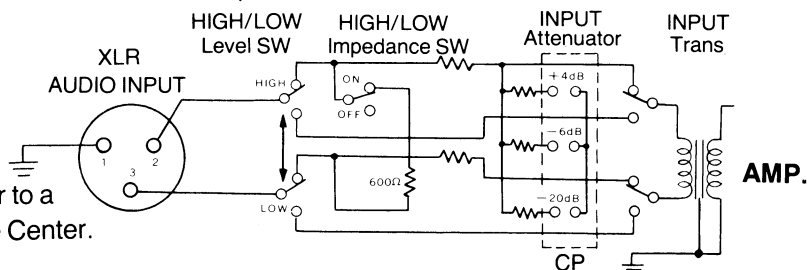
■ Audio Line Level Preselection

The AU-700 is supplied from the factory with the Line (high) level audio input wired for a nominal +4 dB input. This may be changed to -6 dB or -20 dB by internally soldering across different circuit board conductors called "cut points" (CP).

These Cut Points are located on the circuit board just behind the audio input connectors within the machine. Seek technical assistance if the location and procedure is not readily apparent.

Follow the chart and simplified schematic shown below to select the input level desired. The Low (Microphone) level input will not be affected. Solder the cut point for the level chosen and unsolder the remaining points.

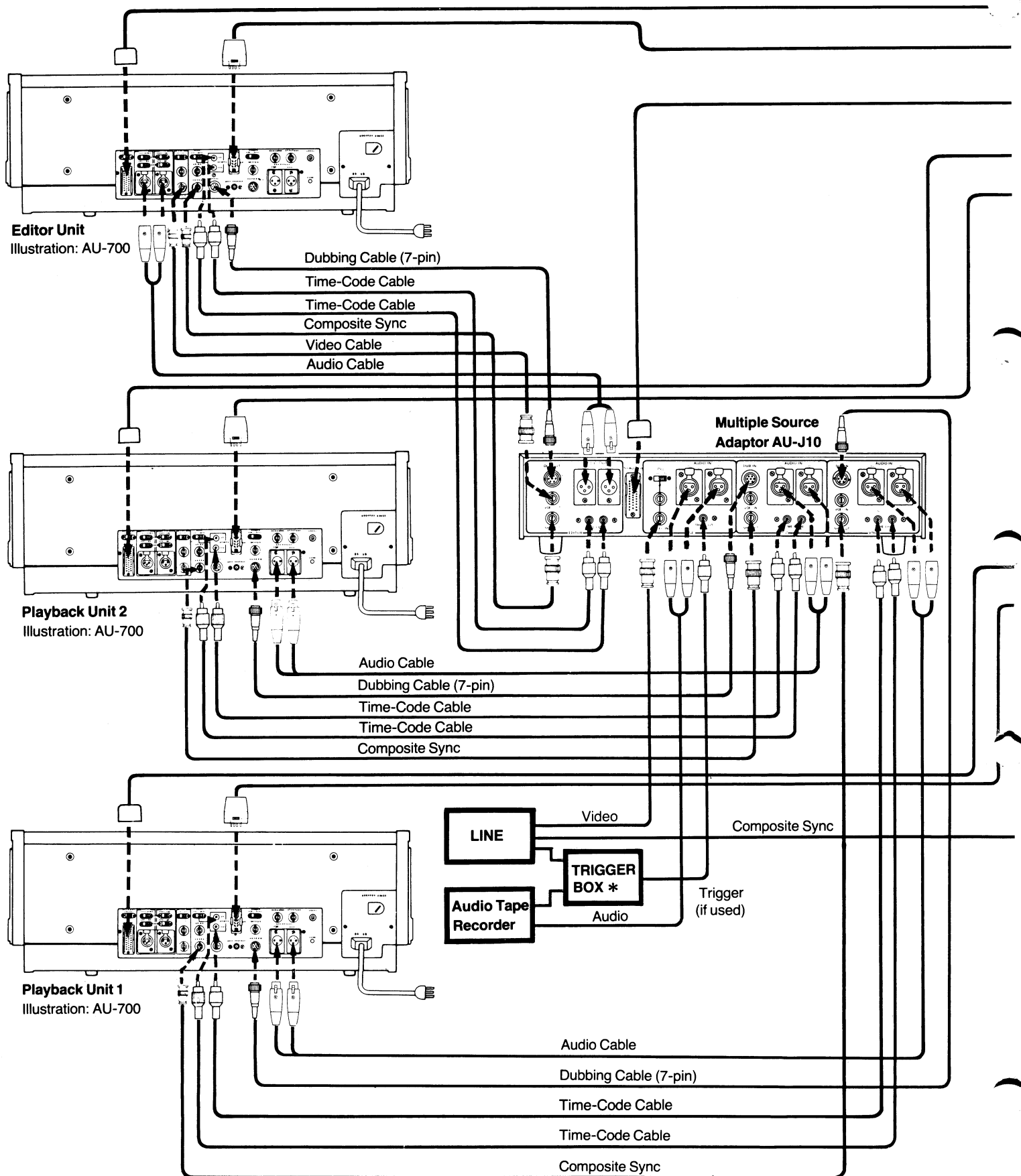
INPUT LEVEL	-20 dB	-6 dB	+4 dB
Channel 1	CP1	CP2	CP3
Channel 2	CP4	CP5	CP6

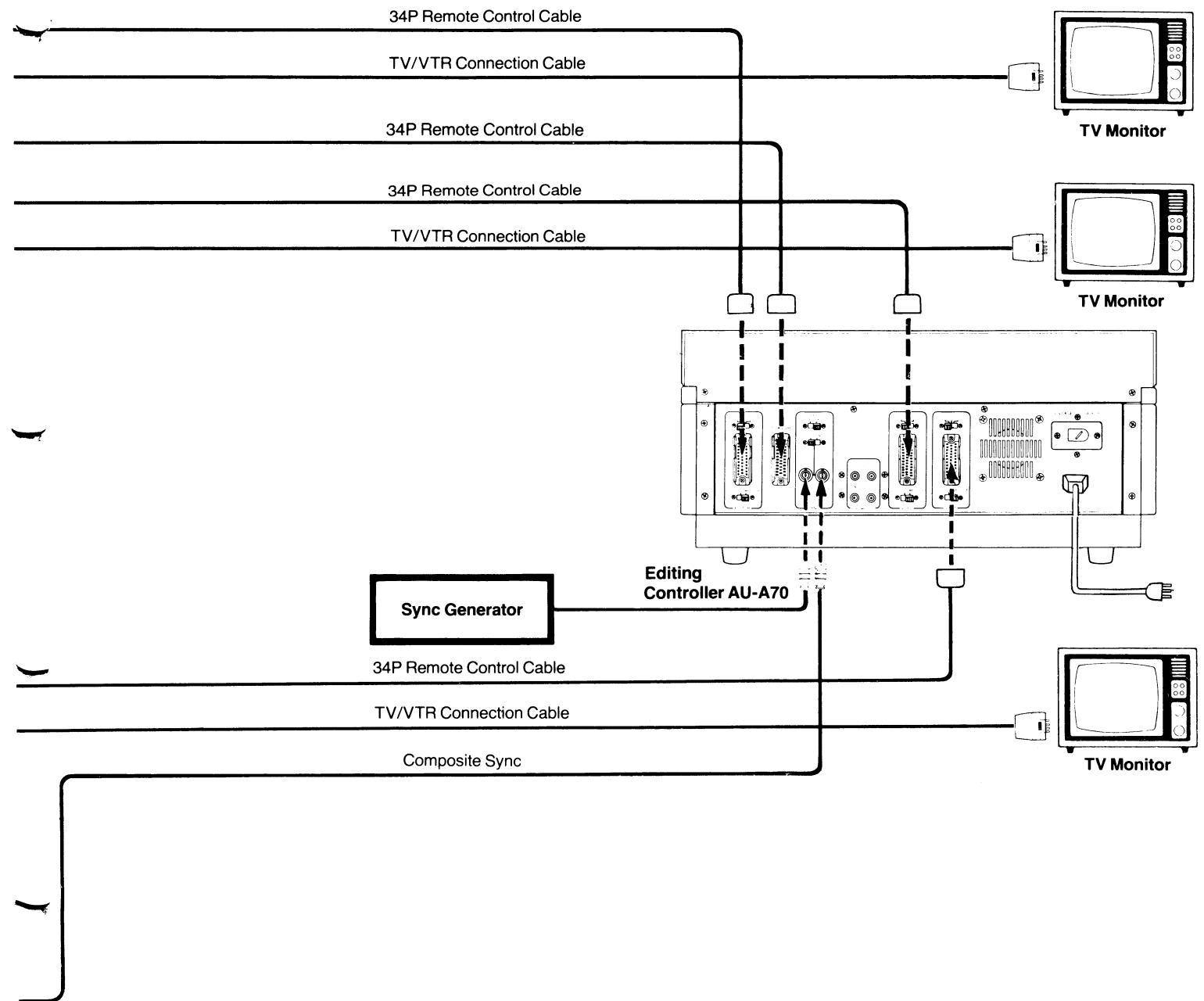


For further information or assistance, refer to a Panasonic dealer or an authorized Service Center.

CONNECTIONS

Before making connections, check to be sure that the power switch of the VTR and of the controller are turned off.





*TRIGGER BOX

This is the control box for supplying trigger pulse to LINE input signal in order to start it automatically during editing. When the tape on the editor reaches at 4.5 sec point before the edit-start point, trigger pulse is sent from AU-J10 to LINE input, and then the LINE will start automatically.

Compose the trigger control box in the operator's side.
For details, consult your local dealer.

- Output Level: Open-collector output (NPN)
OFF: less than DC 12 V
ON: less than 10 mA
- Pulse Width: Approx. 100 ms
- Pulse: Negative pulse

PREPARATIONS

Operation procedure is as follows:

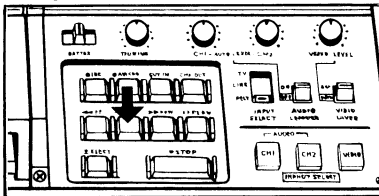
1. Preparation of the Source—playback unit or the video camera
2. Preparation of the Editor unit
3. Editing by the editing controller AU-A70

●Preparation of the playback unit-1

(1) Insertion of the cassette tape

Insert the prerecorded tape cassette into playback unit-1.

(2) Checking of the playback picture

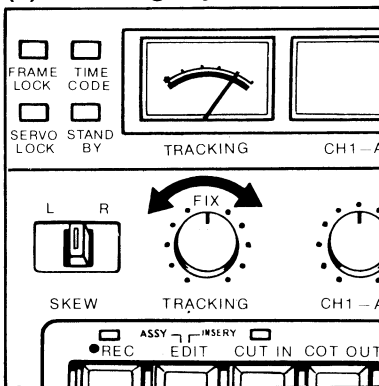


Press the Play Button, and check if the proper recorded video image appears. Programmed editing is not possible unless time-code signals have recorded on the tape. Confirm that the Time-Code Lamp has illuminated.

Note:

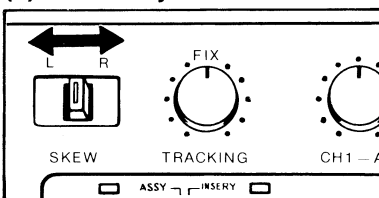
The color in the image shown by the TV monitor may be abnormal if the video cable (BNC type) is used for video signal, but this is not a malfunction. Color processing will be done by the future playback unit after editing.

(3) Tracking adjustment



Adjust the Tracking Control so that the Tracking Meter needle deflects as far to the right as possible, especially if "noise" appears in the video image of the prerecorded tape to be edited.

(4) Skew adjustment



If the upper part of the playback picture "bends" to the left, move the Skew Control toward the "R" indication in order to make the adjustment. If the upper part of the playback picture "bends" to the right, move the Skew Control toward the "L" indication in order to make the adjustment.

(5) Stop

After checking the playback picture, press the Stop Button to stop the tape.

●Prepare playback unit-2 in the same way as for playback unit-1 if a second unit is to be used.

●Preparation of the video camera (if used)

(1) Turn on the power of the video camera.

(2) Adjustment of the video camera picture.

Check the picture of the video camera to be used for recording, and adjust the color temperature, lens opening, focus and scene as may be required.

For additional information, carefully read the operation instructions for the video camera.

2. Preparation of the editor unit

(1) Insertion of the cassette tape

Before inserting the cassette, confirm that the red button on its bottom side is intact. Editing is impossible if this button is missing.

(2) Confirmation of the input signals

Use the editing controller (AU-A70) for the following steps.

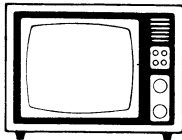
●Playback of unit-1

Press the Playback Unit-1 Button [VTR 1].

Note:

If a BNC-type connector is used for the cable for the video signal, the color of the picture shown on the TV monitor connected to the playback unit may not be normal, but this is not a malfunction.

●Checking the editing signal



When playback is started, by pressing the Play Button, the playback image from the playback unit will appear on the TV monitor of the editor unit. Proceed to adjustment of video level.

●Stopping of the playback unit

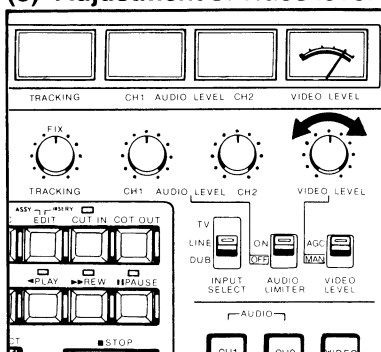
After checking of the editing signal, press the Stop Button to stop the playback unit.

To check the input signal from playback unit-2, press the Playback Unit-2 Button [VTR 2], and then, in the same way as for playback unit-1, press the Play Button to begin operation.

To check the input signal from the video camera, the input signal will appear on the screen of the editor unit TV monitor of unit when the Line Button [LINE] is pressed.

- After finishing the checking of the input signal of the video camera, select the playback unit by pressing the Playback Unit-1 Button or the Playback Unit-2 Button, and then press the Play Button to place the playback unit in the playback mode.

(3) Adjustment of video level



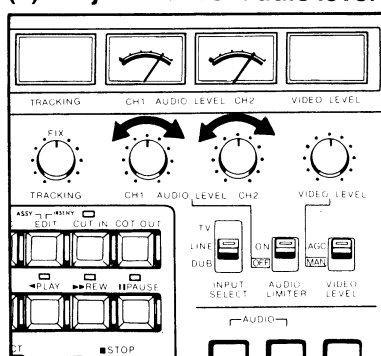
Automatic:

When the Video Level Selector is set to the "AGC" position, the video recording level will be automatically adjusted. Since the AU-700 has keyed AGC, this is the preferred mode.

Manual:

For manual adjustment of the video level, set the Video Level Selector to the "MAN" position, and then make the adjustment, by using the Video Level Control, so that the indication needle of the level meter is within the proper range for recording (blue line). If the video level is adjusted manually, note that each playback unit and the video camera must also be checked, and the adjustment may be required.

(4) Adjustment of audio level

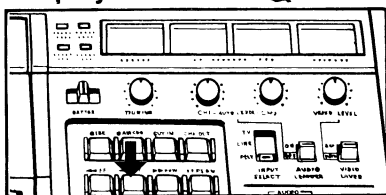


Adjust, the Audio Level Control for channel 1/channel 2, so that the indication needle of the level meter shows the maximum reading without moving to the right of the 0 dB indication.

If large-magnitude audio signals momentarily enter the recording input, set the Audio-Limiter Selector to the "ON" position. By doing so, the audio limiter (volume-limiting circuitry) will function, making possible recordings without overload.

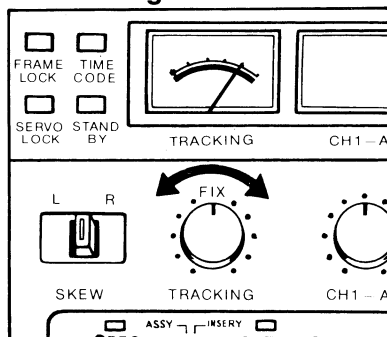
The limiter will operate for both channel.

(5) Confirmation of editor playback



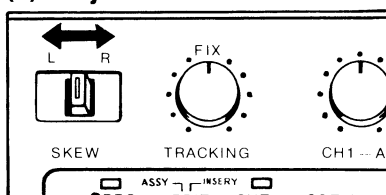
When editing a prerecorded tape, press the Play Button, and check the video image of the tape to be edited. While in the PLAY mode, proceed to adjust Tracking, Skew and Horizontal Phase as outlined below.

(6) Adjustment of editor unit tracking



Adjust the Tracking Control so that the Tracking Meter needle deflects as far to the right as possible, especially if "noise" appears in the video image of the prerecorded tape to be edited.

(7) Adjustment of skew

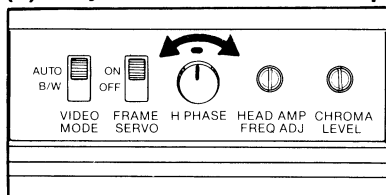


If the upper portion of the video image distorts to the left, move the Skew Control to the right "R".

If the upper portion of the video image distorts to the right, move the Skew Control to the left "L".

This adjustment changes tape tension. For more precise adjustment, observe the real switching point within vertical sync (utilize a cross pulse monitor).

(8) Adjustment of horizontal phase



Before editing, adjust the phase of the editor and playback video signals.

Turn the Frame Servo Switch of the editor unit on, and adjust the Horizontal Phase Control until the Frame Lock Lamp on the front of the unit illuminates.

If playback video signal is non-standard (non-RS170A interlaced) signal, turn the Frame Servo Switch off.

When including the AU-J10 for editing system, adjust the horizontal phase as follow;

1. Press the Line Button.
2. Play back the editor unit.
3. Adjust the horizontal phase of the editor unit in the way above mentioned.
If the blank tape is inserted into the editor unit, place the Horizontal Phase Control in the center position.
4. Press the Playback unit 1 [VTR 1] Button. Play back the playback unit and editor unit, and adjust the Horizontal Phase Control of the playback unit until the Frame Lock Lamp on the editor unit illuminates. Then press the Stop Button of the playback unit.
5. Press the Playback unit 2 [VTR 2] Button, and adjust the horizontal phase in the same way.

If line connection is not used, adjust the horizontal phase in the playback unit side until the Frame Lock Lamp on the editor unit illuminates.

(9) Stop the playback unit

Press the Playback Stop Button of the Editing Controller.

For convenience, rewind the tape to the vicinity of the edit-start point at this time, and then stop.

(10) Stop the editor unit

Press the Editor Stop Button of the Controller to stop playback of the prerecorded tape.

For convenience, rewind the tape to the vicinity of the edit point at this time.

Note:

Once editing has begun, do not touch the Tracking Control under any circumstances.

ENTRY OF THE TIME-CODE SIGNALS

Because the AU-A70 editing controller has a built-in time-code generator and reader, it can be used both for recording the time code signals and for pre-programmed editing using the time code system. Without the time code signals, the edit condition can only perform one edit automatically. With the time code, up to 20 edit events may be stored.

For programmable editing, the time-code signals must be entered onto the cassette tape before the actual editing process may be in. To do so, follow the procedure described below.

Since the time code address track of the AU-700 is interleaved with the video track, time code may only be recorded on that track during original recording. To accomplish this, cable the time code signal to the recorder as previously described. Follow the directions below to reset and start the time code generator, and record the video and audio normally. The time code signal will be recorded simultaneously.

If the tape upon which time code signals are to be recorded already has program material on it, only the audio Channel 1 time code option may be used in conjunction with the CH 1 audio insert mode.

Utilize the rear panel time code mode select switch to choose the desired track.

Follow the directions below, but rather than record mode, place the unit in CH 1 insert mode. (When NV-9240 is used, place the unit in AUDIO DUB mode.)

If the time code hold button is pressed, the generator will repeatedly send out the same time code over and over, and the tape, if still recording (on Audio 1 insert) will have the same time address for many points on the tape rather than one address for each point as it should.

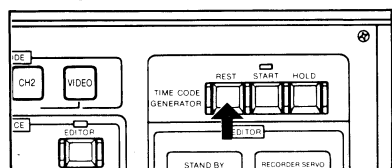
The model NV-9240/9600 has only provision for time code to be recorded in the Audio Channel 1 position, so no track selection is required. However, the Audio CH 1/Time Code switch must be in the Time Code Mode.

●Preparations of the Video Cassette Recorders

Insert a tape cassette into each of the VTRs, and press the Rewind Button to rewind the tape to the starting point of each tape.

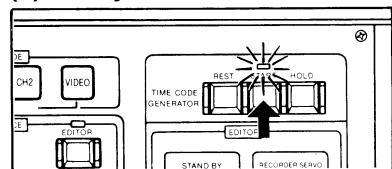
●Use the AU-A70 editing controller to enter the time-code signals.

(1) Setting the Counter Display to "0"



When the Time-Code Reset Button is pressed, the playback unit Counter Display and the editor unit Counter Display are reset, and the "0" indication will appear at the far right of the display.

(2) Entry of the time-code signal



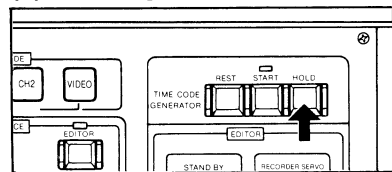
Press the Time-Code Start Button. The Time-Code Start Lamp will illuminate, and the controller will send time-code signals to each VTR.

Then select the Record (or Audio CH 1 insert/Audio Dub mode) mode of each VTR in order to begin recording.

(3) Completion of entry of time-code signal

When the time-code signals have been entered all the way to the end of each tape, press the Stop Button of each VTR.

(4) Holding the time-code counts

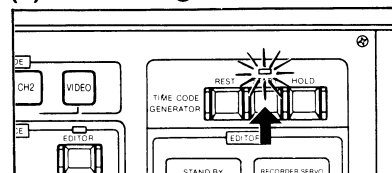


When the Time-Code Hold Button is pressed, the time-code signals will no longer be advance.

(Check to be sure that the Time-Code Start Lamp is not illuminated.)

If the Stop Button of each VTR is not pressed at this time, the same time-code will be repeatedly entered if the tape is moving in the record (or Audio CH 1 insert/Audio Dub) mode. Be absolutely sure to press the Stop Button of each VTR prior to time code hold to prevent this from happening.

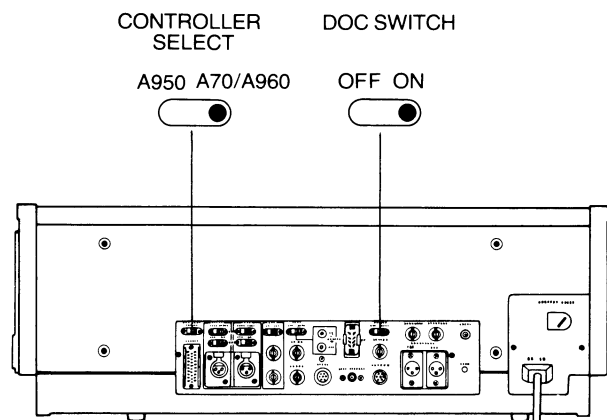
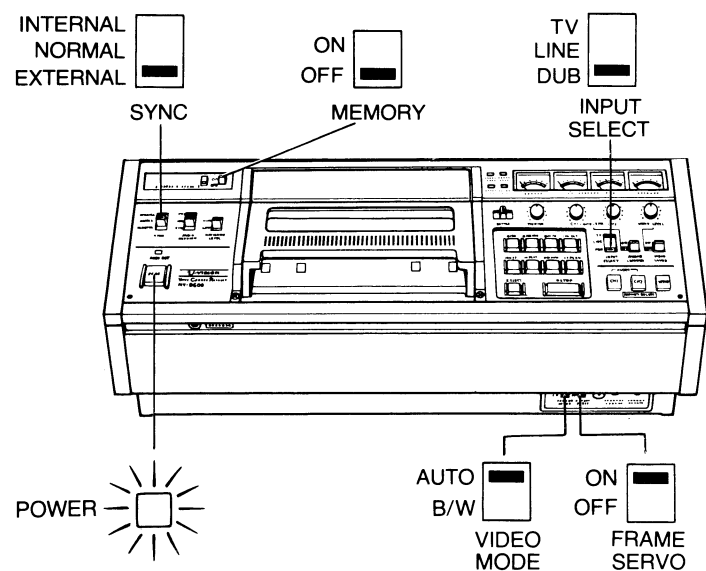
(5) Restarting



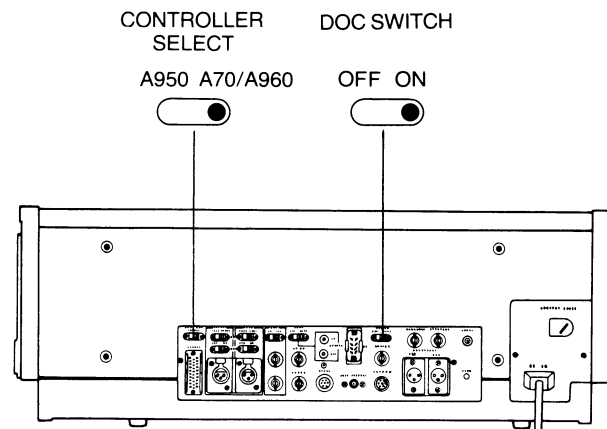
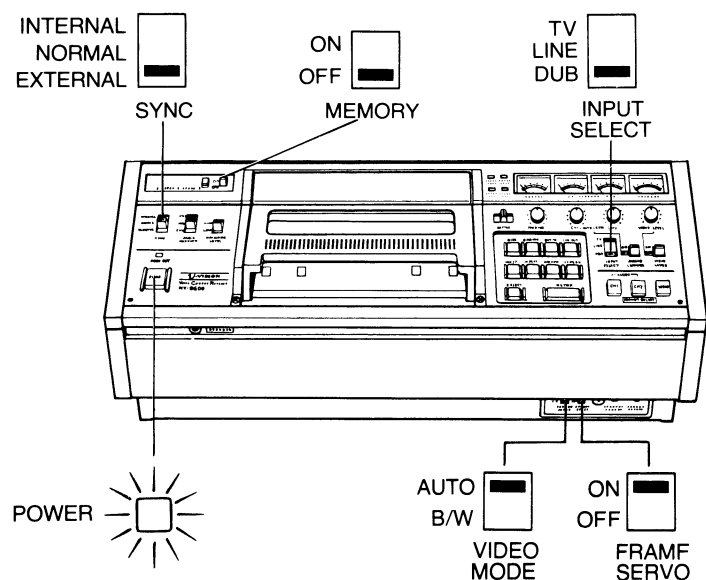
When the Time-Code Start Button is subsequently pressed, the Time-Code Start Lamp will illuminate, and the controller will again count time-code signals.

SWITCH SETTINGS FOR PROGRAM EDITING BY TIME CODE SIGNALS

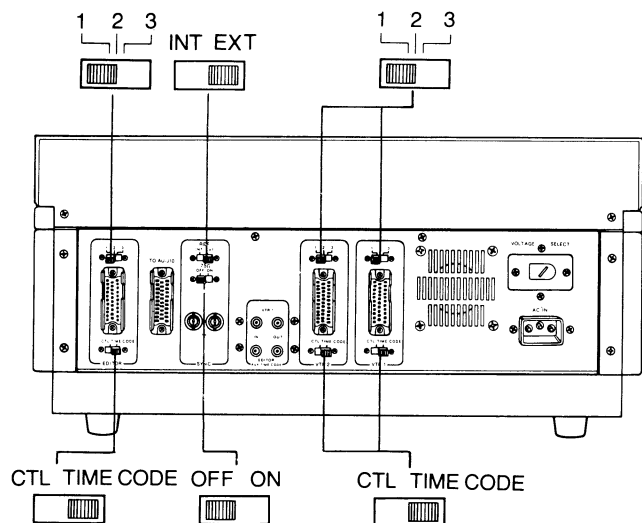
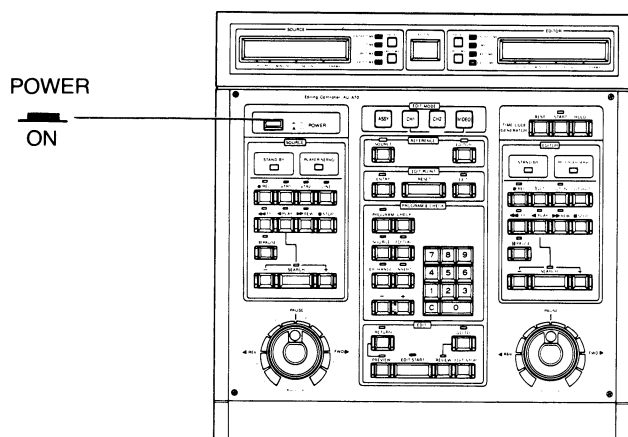
●Switches of Playback Unit (s):



●Editor Switches:



●AU-A70 Editing Controller Switches:



ENTRY OF PROGRAM EDIT POINT BY KEYBOARD

■ OPERATION

Before program editing, check the following points:

- Are all connections of the system and all switch settings made correctly? (Refer pages 171~172.)
- Are the VTRs in the stop mode? (If not, press the Stop Buttons the VTRs.)

If the operation is to be started immediately, it is first necessary to know what program material is recorded on the tape (on which the time-code signal has already been recorded). For that purpose, make a table such as shown below. The explanation of subsequent operations for program editing will be based on this table as the source of data for all examples.

Carefully note the following.

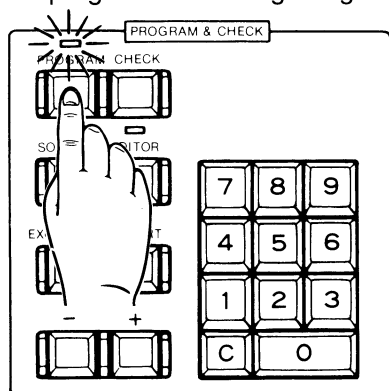
If the program-editing is done in the assemble mode, a blank tape or a tape with unwanted material recorded on it should be used for assemble mode in the editor unit. Refer to page 31 for information concerning assemble editing.

Program Table

Edit Number	Edit Mode	Reference	PLAYBACK UNIT (INCL. "LINE")	PLAYBACK UNIT		EDITOR	
				EDIT-START POINT	EDIT-END POINT	EDIT-START POINT	EDIT-END POINT
1	INSERT (CH2, VIDEO)	EDITOR	VTR 1	7.10.02	—	10.40.15	19.35.07
2	INSERT (CH2)	SOURCE	VTR 2	10.15.13	15.30.20	25.00.00	—
3	INSERT (CH2, VIDEO)	EDITOR	LINE	0	—	31.05.00	31.20.00
4	INSERT (VIDEO)	SOURCE	LINE	0	3.20.00	40.20.07	—
5	INSERT (CH2, VIDEO)	EDITOR	VTR 1	43.25.00	—	50.40.01	55.40.01

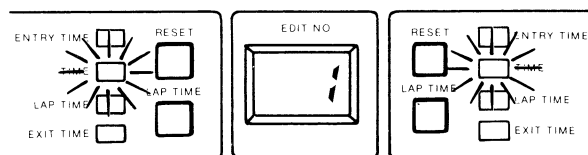
(1) Setting the edit number

The AU-A70 Editing Controller can be used for pre-programming a maximum of 20 edit events. For programmed editing using the time-code, set the edit number as described below.

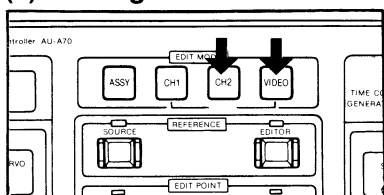


- (1) Press the Program Button (Check to be sure that the Program Lamp has illuminated.)
- (2) Press the Numeric Button "1". The Edit Number Display [EDIT NO.] will show the "1" display, as shown in the figure below. The Time Indication Lamp for the playback side Counter Display and the Time Indication Lamp for the editor side Counter Display will then illuminate. Both the Playback Unit and the Editor Unit Counter Displays will show "0" indication.)

If the incorrect edit number is selected, the indication can be erased by pressing the "C" button. Note that the edit number is set by using the Numeric Keyboard.



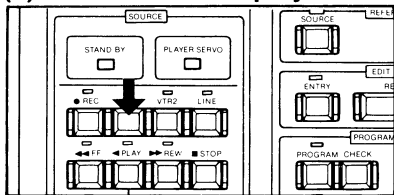
(2) Setting the edit mode



After referring to the first line of the example chart above, note the Edit mode column.

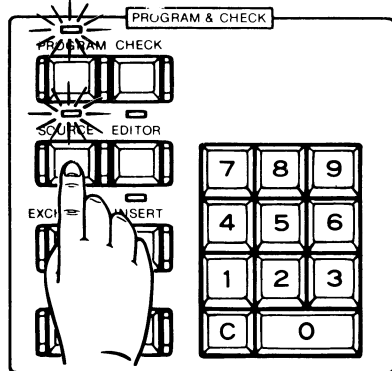
Press the Channel-2 Button and the Video Button. (Both buttons will illuminate.) There is no need to set the edit reference, because it will automatically become the Editor since the insert mode has been selected.

(3) Selection of the playback unit



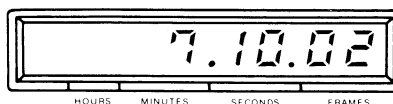
Press the Playback Unit-1 Button [VTR 1]. (Check to be sure that the Playback Unit-1 Lamp has illuminated.)

(4) Entry of the edit points for the playback unit

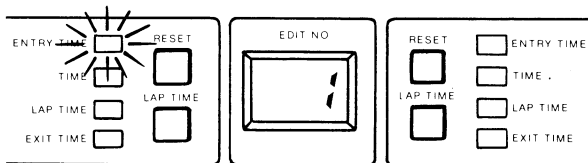


Entry of the edit-start point.

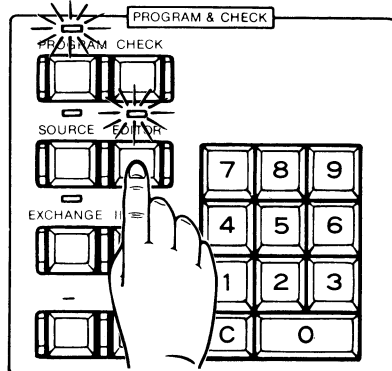
- (1) Press the Source Button [SOURCE]. Check to be sure the Source Lamp has illuminated.
- (2) Use the Numeric Keyboard to obtain the time-code 71002. This "address" of the edit-start point will then appear in the Counter Display of the playback unit.



- (3) When the Entry Button [ENTRY] is pressed, the entry of the edit-start point is completed. Check to be sure that the Entry Lamp has illuminated, and the Counter Display indicates the entry time.



(5) Entry of the edit points for the editor unit

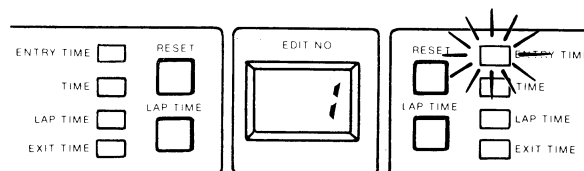


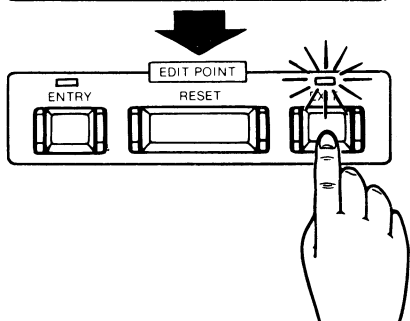
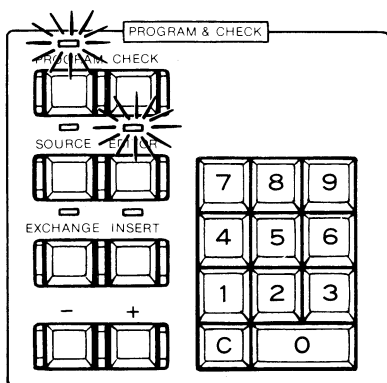
Entry of the edit-start point

- (1) Press the Editor Button [EDITOR]. Check to be sure that the Editor Lamp has illuminated.
- (2) Use the Numeric Keyboard to obtain the time-code 104015. This "address" of the edit-start point will then appear in the Counter Display of the editor unit.



- (3) When the Entry Button [ENTRY] is pressed, the entry of the start-edit point is completed. Check to be sure that the Entry Button has illuminated, and the Counter Display indicates the entry time.





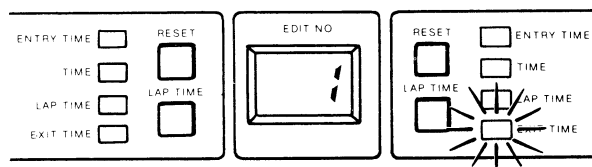
Entry of the edit-end point

- (1) Check that the Editor Lamp is illuminated. If it is not, press the Editor Button [EDITOR].
- (2) Use the Numeric Keyboard to obtain the time-code 193507. The time of the edit-end point will then appear in the Counter Display of the editor unit.

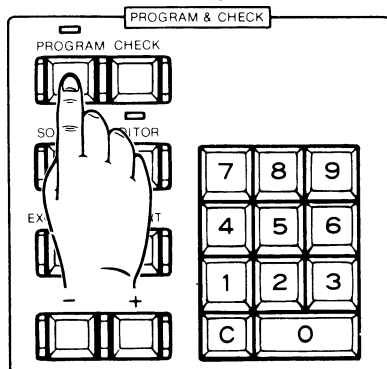


- (3) When the Exit Button [EXIT] is pressed, the entry of the edit-end point is completed.

Check to be sure that the Exit Lamp is illuminated, and the Counter Display indicates the exit time.



(6) Finish the entry of the edit points in programmed edit 1



Press the Program Button [PROGRAM] to finish the entry of the edit points in programmed edit number "1".

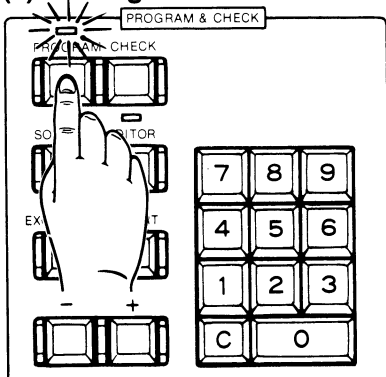
The Program Lamp will be extinguished.

If further edits are to be programmed, mark the example chart to show edit number completed.

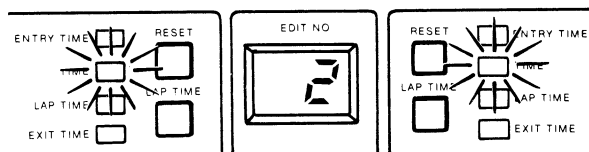
(See the reproduced example below with the "X" next to Edit 1.

Edit Number	Edit Mode	Reference	PLAYBACK	PLAYBACK UNIT		EDITOR	
			UNIT (INCL. "LINE")	EDIT-START POINT	EDIT-END POINT	EDIT-START POINT	EDIT-END POINT
× 1	INSERT (CH2, VIDEO)	EDITOR	VTR 1	7.10.02	—	10.40.15	19.35.07
2	INSERT (CH2)	SOURCE	VTR 2	10.15.13	15.30.20	25.00.00	—

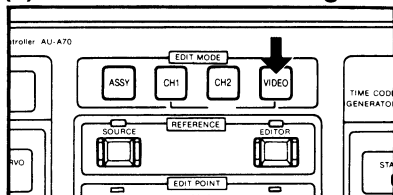
(7) Setting of the edit number



1. Press the Program Button [PROGRAM]. Check to be sure that the Program Lamp is illuminated.
2. The "2" indication will be automatically displayed on the Edit Number Display [EDIT NO.], as shown in the illustration below, and the Time Indication Lamps for the playback unit side and for the editor unit side will illuminate. Both the Playback Unit and the Editor Unit Counter Displays will shown "0" indication.

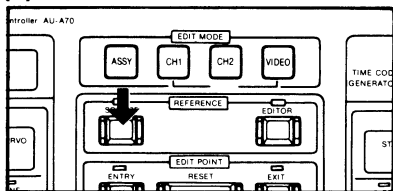


(8) Selection of the editing mode



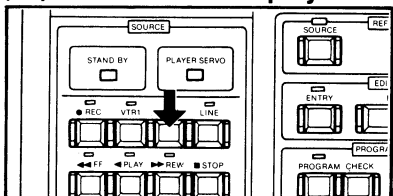
Consult the edit chart. An audio ch 2 only edit is desired. Press the Video Button. The Video Lamp illumination will then go off. Be sure that the Channel-2 Lamp is illuminated. (Recall that video was previously "on".)

(9) Selection of the edit reference



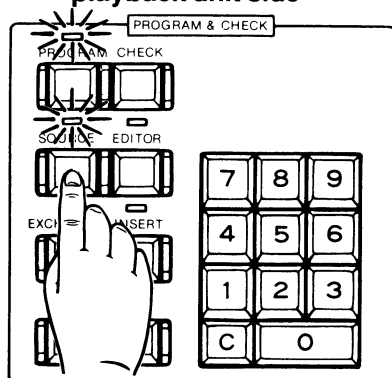
Press the Source Button [SOURCE]. The Source Button will then illuminate.

(10) Selection of the playback unit



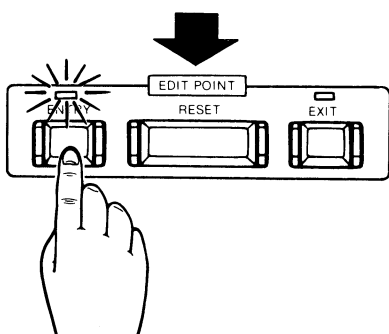
Press the Playback Unit-2 Button [VTR-2]. Check to be sure that the Playback Unit-2 Lamp is illuminated.

(11) Entry of the edit points for the playback unit side

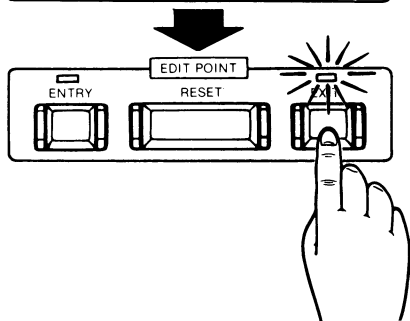
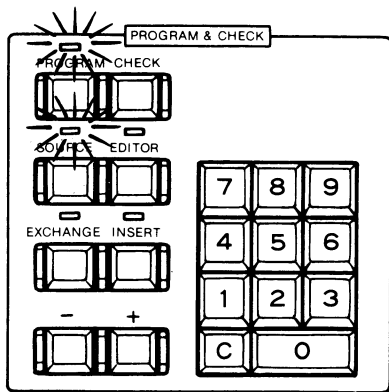


Entry of the edit-start point

- (1) Press the Source Button [SOURCE]. Be sure the Source Lamp has illuminated.
- (2) Use the Numeric Keyboard to obtain the time-code 101513. The time of edit-start point will then appear in the Counter Display of the playback unit.

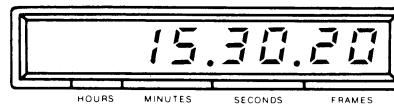


- (3) When the Entry Button [ENTRY] is pressed, the entry of the edit-start point is completed.



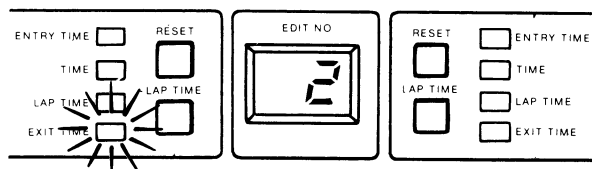
Entry of the edit-end point

- (1) Check that the Source Lamp is illuminated. If it is not, press the Source Button [SOURCE].
- (2) Use the Program Keyboard to obtain the time-code 153020. The time of the edit-end point will then appear in the Counter Display of the editor unit.

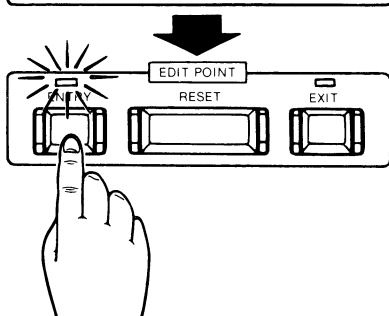
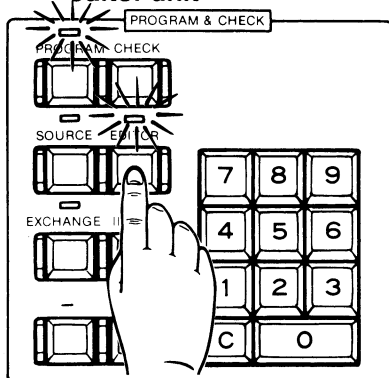


- (3) When the Exit Button [EXIT] is pressed, the entry of the edit-end point is completed.

Be sure that the Exit Lamp is illuminated.



(12) Entry of the edit points for the editor unit



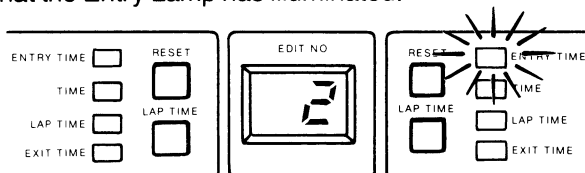
Entry of the edit-start point

- (1) Press the Editor Button [EDITOR]. Check that the Editor Lamp has illuminated.
- (2) Use the Numeric Keyboard to obtain the time-code 250000. The "address" of the edit-start point will then appear in the Counter Display of the editor unit.

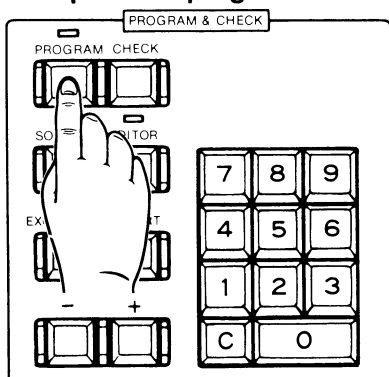


- (3) When the Entry Button [ENTRY] is pressed, the entry of the edit-start point is completed.

Be sure that the Entry Lamp has illuminated.



(13) Finish the entry of the edit points in program "2"



Press the Program Button [PROGRAM] to finish the entry of the edit points in programmed edit number "2".
the Program Lamp will be extinguished.

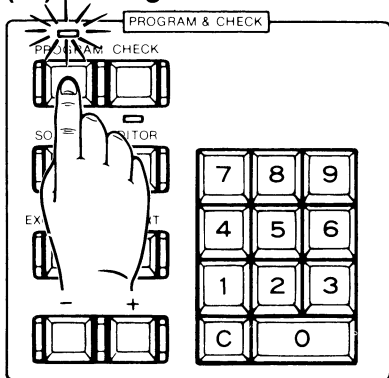
Programmed editing of a video signal

Program Table Example (from page 22):

Edit Number	Edit Mode	Reference	PLAYBACK UNIT (INCL. "LINE")	PLAYBACK UNIT		EDITOR	
				EDIT-START POINT	EDIT-END POINT	EDIT-START POINT	EDIT-END POINT
× 1	INSERT (CH2, VIDEO)	EDITOR	VTR 1	7.10.02	—	10.40.15	19.35.07
× 2	INSERT (CH2)	SOURCE	VTR 2	10.15.13	15.30.20	25.00.00	—
3	INSERT (CH2, VIDEO)	EDITOR	LINE	0	—	31.05.00	31.20.00
4	INSERT (VIDEO)	SOURCE	LINE	0	3.20.00	40.20.07	—
5	INSERT (CH2, VIDEO)	EDITOR	VTR 1	43.25.00	—	50.40.01	55.40.01

(Edits marked with "X" are already entered.)

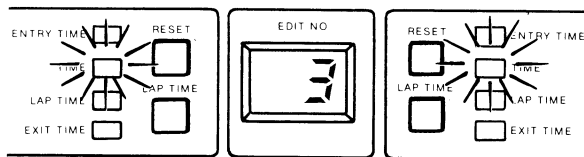
(14) Setting of the edit number



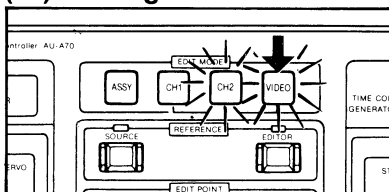
Press the Program Button [PROGRAM]. Check to be sure that the Program Lamp is illuminated.

The "3" indication will be automatically displayed on the Edit Number Display [EDIT NO.], as shown in the illustration below. Check to be sure that the Time Indication Lamp is illuminated.

Both the Playback Unit and the Editor Unit Counter Displays will show "0" indication.



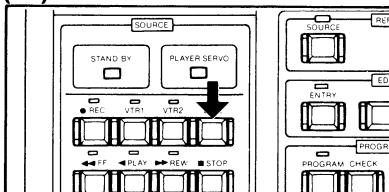
(15) Setting the edit mode



Press the Video Button. Check to be sure that the Channel-2 Lamp and the Video Lamp are illuminated.

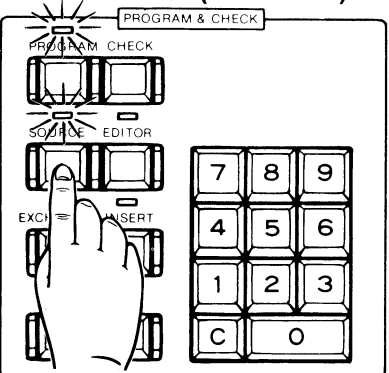
There is no necessity to set the edit reference, because it automatically becomes the editor in the line mode.

(16) Selection of Line

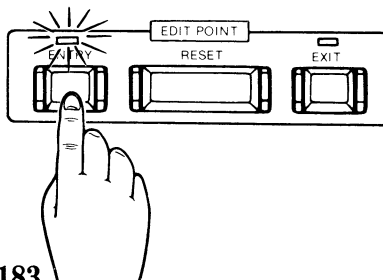


Press the Line Button [LINE]. Be sure that the Line Lamp is illuminated.

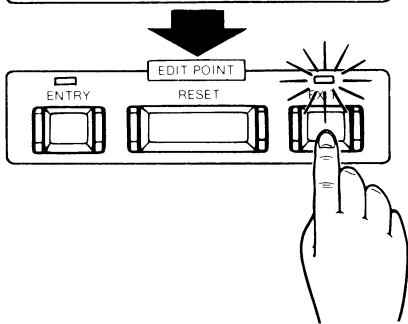
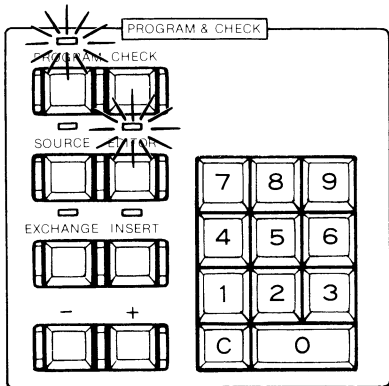
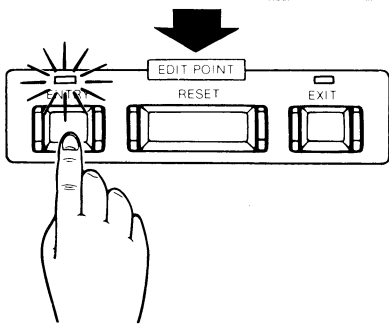
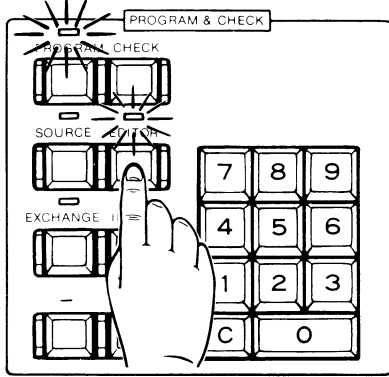
(17) Entry of the edit interval for source (Line Video)



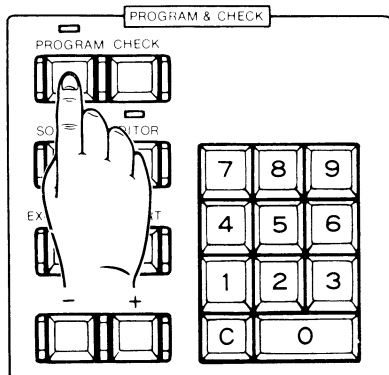
- (1) Press the Source Button [SOURCE]. Be sure the Source Lamp has illuminated.
- (2) Press the Entry Button [ENTRY]. Entry Lamp illuminates.



(18) Entry of the edit points for the editor unit

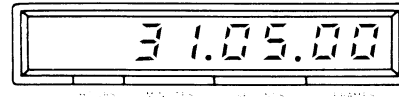


(19) Finish the entry of programmed edit "3"

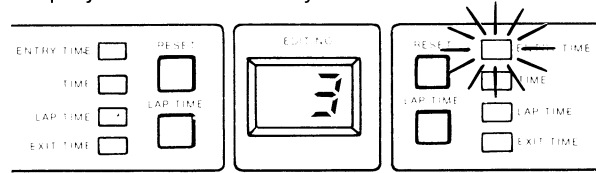


Entry of the edit-start point

- (1) Press the Editor Button [EDITOR]. Check that the Editor Lamp has illuminated.
- (2) Use the Numeric Keyboard to obtain the time-code 310500.
The "address" of the edit-start point will then appear in the Counter Display of the editor unit.

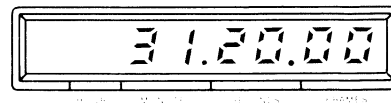


- (3) When the Entry Button [ENTRY] is pressed, the entry of the start-edit point is completed. Check that the Entry Button has illuminated, and the Counter Display indicates the entry time.



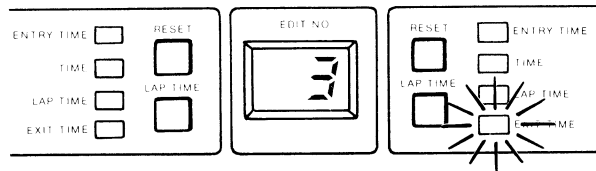
Entry of the edit-end point

- (1) Check that the Editor Lamp is illuminated. If it is not, press the Editor Button [EDITOR].
- (2) Use the Numeric Keyboard to obtain the time-code 312000.
The time of the edit-start point will then appear in the Counter Display of the editor unit.



- (3) When the Exit Button [EXIT] is pressed, the entry of the edit-end point is completed.

Check that the Exit Lamp is illuminated, and the Counter Display indicates the exit time.



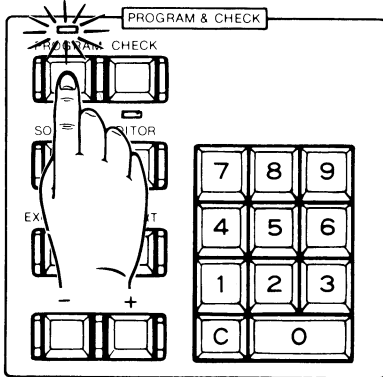
Press the Program Button [PROGRAM] to finish the entry of the edit points for programmed edit number "3".
The Program Lamp will be extinguished.

Program Table Example

Edit Number	Edit Mode	Reference	PLAYBACK UNIT (INCL. "LINE")	PLAYBACK UNIT		EDITOR	
				EDIT-START POINT	EDIT-END POINT	EDIT-START POINT	EDIT-END POINT
× 1	INSERT (CH2, VIDEO)	EDITOR	VTR 1	7.10.02	—	10.40.15	19.35.07
× 2	INSERT (CH2)	SOURCE	VTR 2	10.15.13	15.30.20	25.00.00	—
× 3	INSERT (CH2, VIDEO)	EDITOR	LINE	0	—	31.05.00	31.20.00
4	INSERT (VIDEO)	SOURCE	LINE	0	3.20.00	40.20.07	—

(Edits marked with "X" are already entered.)

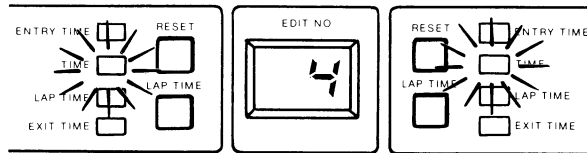
(20) Setting of the edit number



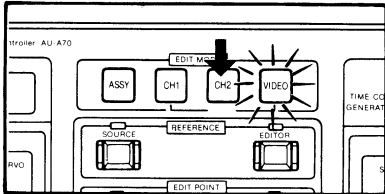
Press the Program Button [PROGRAM]. Check that the Program Lamp is illuminated.

The "4" indication will be automatically displayed on the Edit Number Display [EDIT NO.], as shown in the illustration below. Be sure that the Time Indication Lamp is illuminated.

Both the Playback Unit and the Editor Unit Counter Displays will show "0" indication.

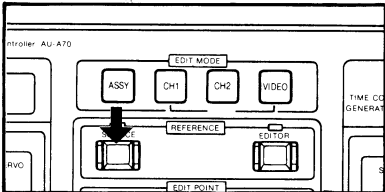


(21) Selection of the edit mode



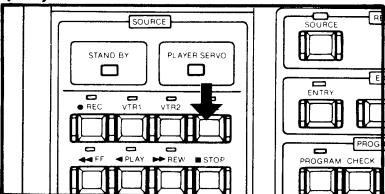
Press the Channel-2 Button. Check that the Video Lamp is illuminated. (This is on from the previous edit.)

(22) Selection of the edit reference



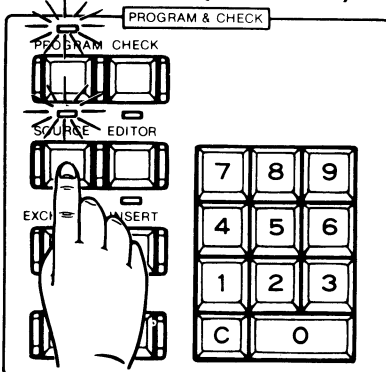
Press the Source Button [SOURCE]. The Source Lamp will then illuminate.

(23) Selection of Line



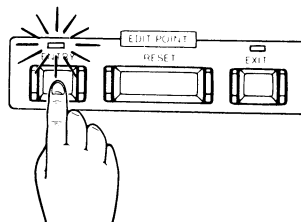
Press the Line Button [LINE]. Be sure that the Line Lamp is illuminated.

(24) Entry of the edit interval for source (Line Video)

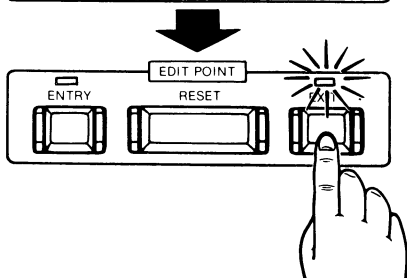
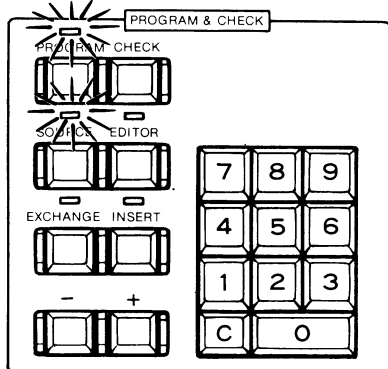


(1) Press the Source Button [SOURCE]. Check that the Source Lamp has illuminated.

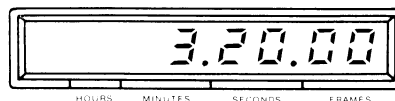
(2) Press the Entry Button [ENTRY]. Entry Lamp illuminates.



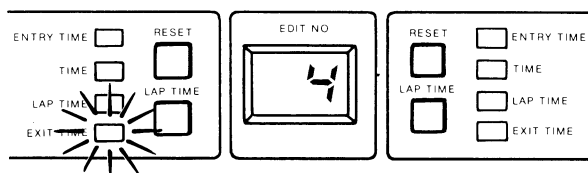
(25) Entry of the edit interval for the source (Line Video)



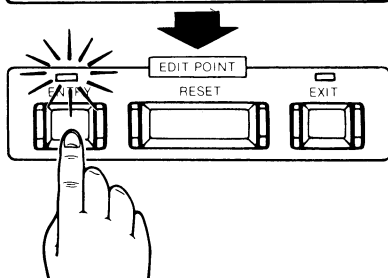
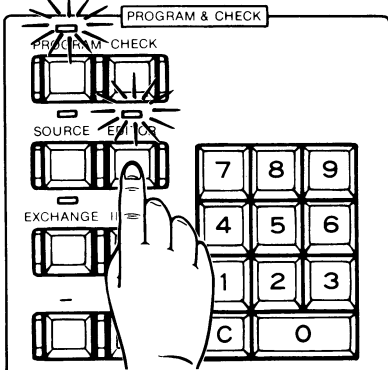
- (1) Check that the Source Lamp is illuminated. If it is not, press the Source Button.
- (2) Use the Numeric Keyboard to obtain a video line input signal editing time (interval) of 3 minutes and 20 seconds 32000. The video signal editing time will appear in the Counter Display of the playback unit side.



- (3) When the Exit Button [EXIT] is pressed, the entry of the line edit interval is completed. Be sure that the Exit Lamp is illuminated.

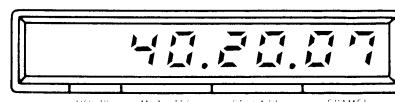


(26) Entry of the edit point for the editor unit

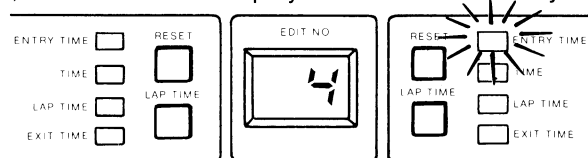


Entry of the edit-start point

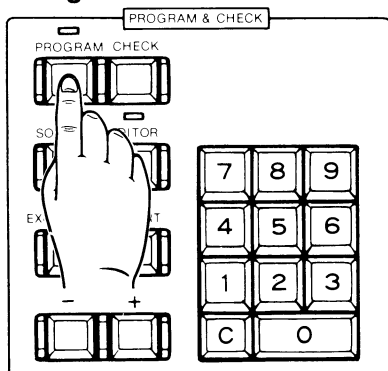
- (1) Press the Editor Button [EDITOR]. Check to be sure that the Editor Lamp has illuminated.
- (2) Use the Numeric Keyboard to obtain the time-code 402007.



- (3) When the Entry Button [ENTRY] is pressed, the entry of the start-edit point is completed. Check that the Entry Button has illuminated. When the entry of the edit-start point is finished, the Entry-Time Indication Lamp of the Counter Display of the playback unit side and the Entry-Time Indication Lamp of the Counter Display of the editor unit side will illuminate, and the Counter Displays will indicate the entry time.



(27) Finish the entry of programmed edit "4"



Press the Program Button [PROGRAM] to finish the entry of the edit number "4".
The Program Lamp will be extinguished.

Thereafter, by following the program table, any number of edit points from "5" up to 20 can be programmed as desired. After finishing the setting of the edit points, follow the Edit Checking steps described on pages 190 through 201.

Use of Blank Tape (Assemble-editing)

If blank tape upon which no time-code signal has been recorded is inserted into the editor unit, perform program editing by the assemble-edit method in the way described below.

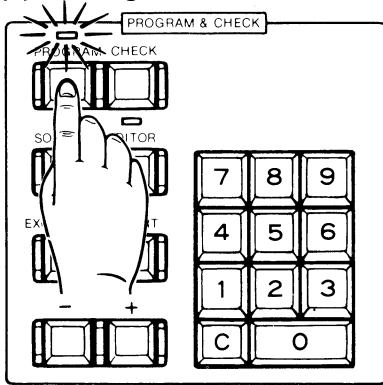
Note:

Before beginning, select the proper tape location at the editor for the start of program.

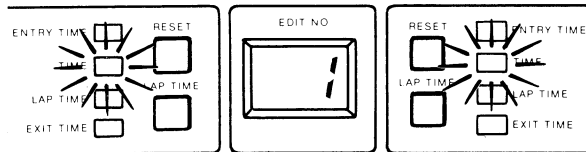
Program Table

Edit No.	Edit Mode	Edit Ref.	PLAYBACK UNIT (INCL. "LINE")	PLAYBACK UNIT		EDITOR UNIT	
				EDIT-START POINT	EDIT-END POINT	EDIT-START POINT	EDIT-END POINT
1	ASSEMBLE	SOURCE	VTR 1	5.20.00	10.20.00	—	—
2	ASSEMBLE	SOURCE	VTR 2	15.05.13	30.10.20	—	—
3	ASSEMBLE	SOURCE	LINE	0	05.00.00	—	—
4	ASSEMBLE	SOURCE	VTR 2	35.17.29	50.20.03	—	—

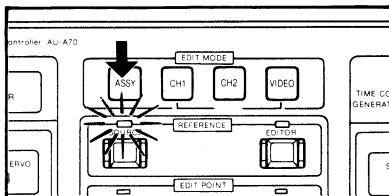
(1) Setting the edit number



- (1) Press the Program Button [PROGRAM]. Check that the Program Lamp has illuminated.
- (2) Press the Numerical Keyboard "1". The Edit Number Display [EDIT NO.] will show the "1" display as shown in the figure below. In addition, the Time Indication Lamps, for the Counter Displays of the source side and the editor side, will illuminate. The Counter Displays of the source side and the editor side will show "0" indication.

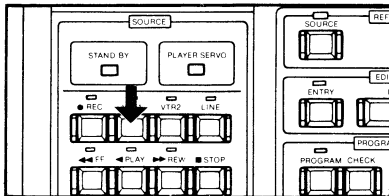


(2) Selection of the edit mode



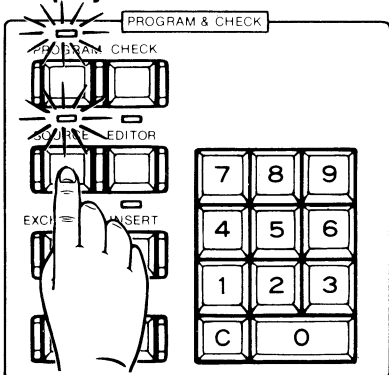
Press the Assembly Button [ASSY]. The Assembly Button will illuminate. It is not necessary to make an edit reference selection because the edit reference is automatically the playback unit in the assemble mode.

(3) Selection of the playback unit



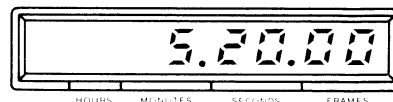
Press the Playback Unit-1 Button [VTR 1]. Check that the Playback Unit-1 Lamp has illuminated.

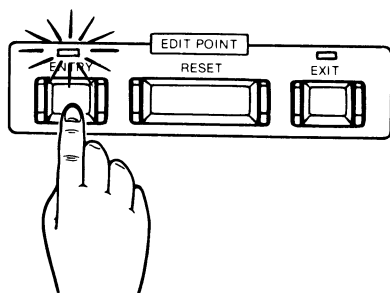
(4) Entry of the edit points for the playback unit



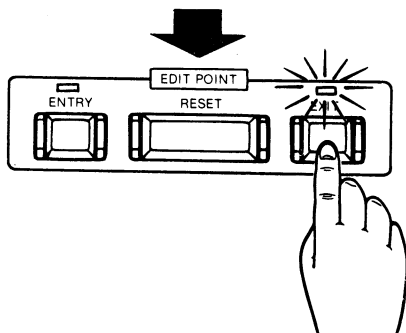
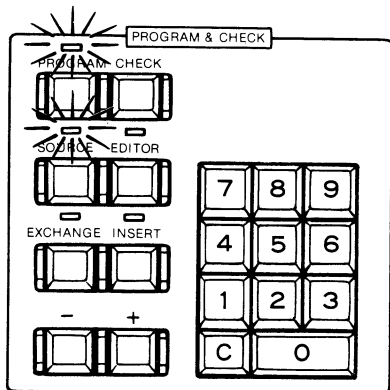
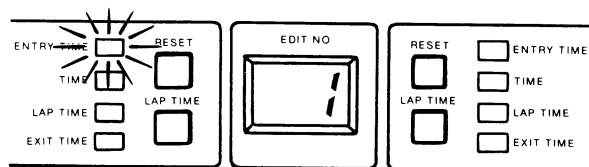
Entry of the edit-start point

- (1) Press the Source Button [SOURCE]. Be sure the Source Lamp has illuminated.
- (2) Use the Numerical Keyboard to obtain the time-code 52000. The "time" of the edit-start point will then appear in the Counter Display of the playback unit.





- (3) When the Entry Button [ENTRY] of the editor is pressed, the entry of the start-edit point is completed. Be sure that the Entry Lamp has illuminated, and the Counter Display indicates the entry time.

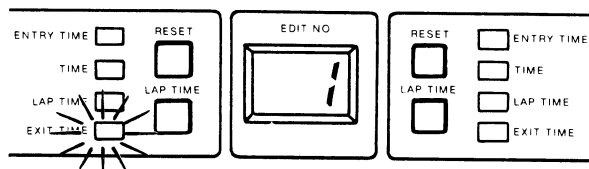


Entry of the edit-end point

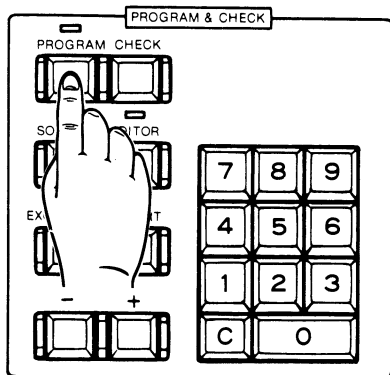
- (1) Check to be sure that the Source Lamp is illuminated. If it is not, press the Source Button [SOURCE].
- (2) Use the Numerical Keyboard to obtain the time-code 102000.
The time of the edit-end point will appear in the Counter Display of the playback unit side.



- (3) When the Exit Button [EXIT] is pressed, the entry of the edit-end point is completed. Check to be sure that the Exit Lamp is illuminated, and the Counter Display indicates the exit time.



(5) Finish the entry of programmed edit "1"



Press the Program Button [PROGRAM] to finish the entry of the edit points in programmed edit number "1".
The Program Lamp will be extinguished.

Program Table Example

EDIT NO.	EDIT MODE	EDIT REF.	PLAYBACK UNIT (INCL. LINE)	PLAYBACK UNIT		EDITOR UNIT	
				EDIT-START POINT	EDIT-END POINT	EDIT-START POINT	EDIT-EDN POINT
× 1	ASSEMBLE	SOURCE	VTR 1	5.20.00	10.20.00	—	—
2	ASSEMBLE	SOURCE	VTR 2	15.05.13	30.10.20	—	—
3	ASSEMBLE	SOURCE	LINE	0	5.00.00	—	—
4	ASSEMBLE	SOURCE	VTR 2	35.17.29	50.20.03	—	—

(Edit number marked with X is already entered.)

Edit points "2" and thereafter can be entered by repeating steps (6) through (10) below. Check to be sure that the Source Lamp and the Assembly Button are illuminated. If not, press the corresponding button, and check once again to be sure both are illuminated.

(6) Setting the edit number

Press the Program Button [PROGRAM]. (Check to be sure that the Program Lamp has illuminated.)
The edit number will be automatically increased by one.

(7) Selection of the playback unit

Select the proper playback unit or the line source.
To use playback unit-1, press the Playback Unit-1 Button [VTR 1].
To use playback unit-2, press the Playback Unit-2 Button [VTR 2].
To use a line source, press the Line Button [LINE].

(8) Entry of edit-start point

- (1) Check to be sure that the Source Lamp is illuminated. If it is not, press the Source Button [SOURCE].
- (2) Use the Numerical Keyboard to obtain the time-code of the edit-start point.
- (3) Press the Entry Button [ENTRY]. Check to be sure that the Entry Lamp is illuminated.

(9) Entry of edit-end point

- (1) Check to be sure that the Source Lamp is illuminated. If it is not, press the Source Button [SOURCE].
- (2) Use the Numerical Keyboard to obtain the time-code of the edit-end point.
- (3) Press the Exit Button [EXIT]. Be sure the Exit Lamp is illuminated.

(10) Finish the entry of the edit points

Press the Program Button [PROGRAM] to finish the entry of the edit points.
The Program Lamp will be extinguished.

Thereafter, by following the program table, enter the edit points for the desired number (up to a maximum of 20) of programmed edits. When the entry of the edit points is completed, follow the Edit Checking steps described on pages 190 through 201.

When a tape with pre-recorded black-burst and time-code signals is used . . .

If tape on which the black-burst and the time-code signals have been recorded is inserted into the editor unit, program editing can be performed by the insert-edit method. But be sure that the Edit Mode is INSERT, and that the Edit Reference is SOURCE side. The editing operation is performed in the same way as the assemble-editing.

Operation

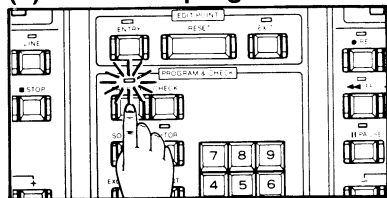
- (1) Set the edit number.
- (2) Select the edit mode: Press the Insert Button.
- (3) Select the edit reference: Press the Source Button.
- (4) Select the playback unit.
- (5) Enter the edit-start point.
- (6) Enter the edit-end point.
- (7) Finish the entry of the edit points.

Thereafter, by following the program table, enter the edit points for the desired number (up to a maximum of 20) of programs. When the entry of the edit points is completed, follow the Edit Checking steps described on pages 190 through 201.

■ Checking the edit program

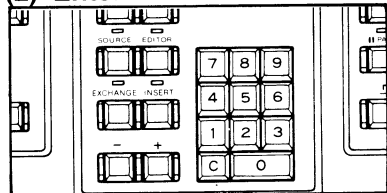
To check the edit program before actual editing, follow the steps below.

(1) Press the program button



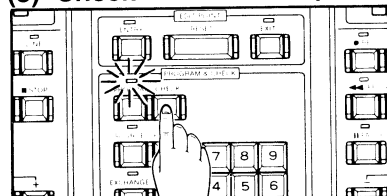
Press the Program Button [PROGRAM]. Be sure the Program Lamp is illuminated.

(2) Enter the edit number



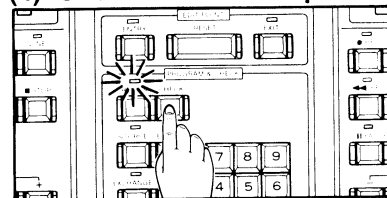
Use the Numerical Keyboard to enter the number of the edit to be checked. The edit number will be indicated on the Edit Number Display.

(3) Check the edit-start point



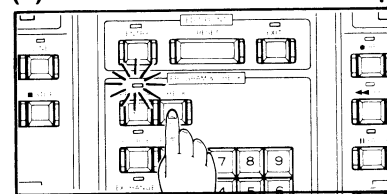
Press the Check Button [CHECK].
The time-codes of the entered edit-start points will be displayed on the Counter Display of the source side and editor side as well as the Entry Time Lamps.
The illumination of the respective lamps will indicate the playback unit, edit reference, and the edit mode selected for this edit number.

(4) Check the edit-end point



Press the Check Button [CHECK].
The Exit-Time Indication Lamps for the Counter Displays of the source side and the editor side will illuminate. The time-code of the entered edit-end point will be indicated by the Counter Display for the edit reference side (either source or editor) previously selected for this edit.

(5) Check the next edit-start point

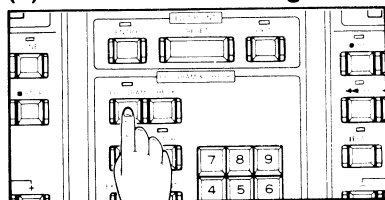


Press the Check Button [CHECK].
The edit number will automatically increase by one, and the Counter Displays will automatically indicate the edit-start points.

(6) Checking subsequent edits

Next check the edit program by repeatedly pressing the Check Button.
If checking is continued beyond the number of entered programmed edits, the number will return to the first edit number.

(7) Finish the checking



When the checking is finished, press the Program Button [PROGRAM].
The Program Lamp will be extinguished.

Note:

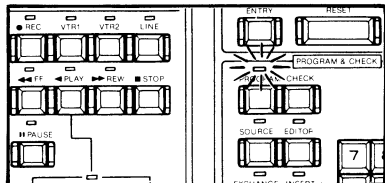
If the Counter Display shows the "0" indication and the illumination of the various lamps (edit mode, edit reference, playback unit) does not occur, the program for that edit number has not been entered. If this happens, reprogram that edit once again.

■ Correction Of The Edit Program

To correct the edit program before editing, follow the steps below.

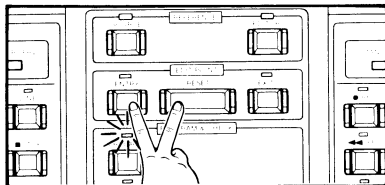
(1) Check the edit program (Refer to page 190.) to find any needed corrections.

(2) Selection of the video to be corrected

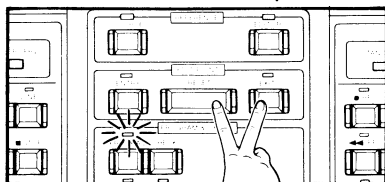


(3) Reset operation

●Reset of the edit-start point



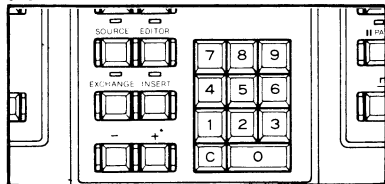
●Reset of the edit-end point



(4) Check whether or not there is an error of the edit mode or the edit reference.

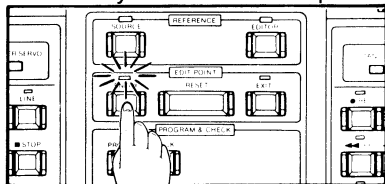
(If there is an error in the program, make the necessary correction.)

(5) Correction of the edit point

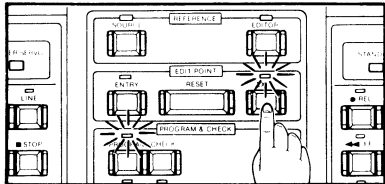


(6) Re-entry of the edit point

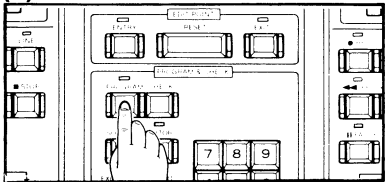
●Re-entry of the edit-start point



●Re-entry of the edit-end point



(7) Finish the correction



Select the VTR (Playback Unit or Editor Unit) to be corrected by pressing the Source or Editor Button.

●When the Source Button is pressed . . .

Select VTR 1, VTR 2 or Line by pressing the Playback Unit-1 (VTR 1), Playback Unit-2 (VTR 2) or the Line (LINE) Button.

To correct the edit-start point, press the Entry Button [ENTRY] and the Reset Button [RESET] at the same time in order to erase the previous entry. (The previous time-code will remain on the Counter Display.)

To correct the edit-end point, press the Exit Button [EXIT] and the Reset Button [RESET] at the same time in order to erase the previous entry. (The previous time-code will remain on the Counter Display.)

These are the following 2 ways to correct the edit point:

a) Correction by using the Numeric Keyboard:

Enter new edit points by use of the Numeric Keyboard.

b) Correction by using the Time-Shift Plus/Minus Buttons:

To correct the time-code in frame units, use the Time-Shift Plus Button or the Time-Shift Minus Button. The time-code of the Counter Display will advance one frame each time the Time-Shift Plus Button is pressed. The time-code of the Counter Display will return one frame each time the Time-Shift Minus Button is pressed.

Re-enter the edit point by pressing the Entry Button [ENTRY] if the edit point to be corrected is the edit-start point.

Re-enter the edit point by pressing the Exit Button [EXIT] if the edit point to be corrected is the edit-end point.

When the correction is finished, press the Program Button [PROGRAM]. The Program Lamp will be extinguished.

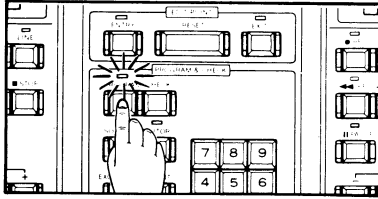
Note:

When the edit reference is corrected, be sure to enter the edit point once again in both playback and editor unit sides.

■ Partial Program Cancellation

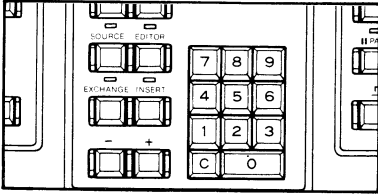
If it is desired, before editing, to cancel a certain program after editing, follow the steps below.

(1) Press the program button



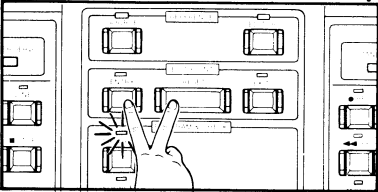
Press the Program Button [PROGRAM]. (Check to be sure that the Program Lamp is illuminated.)

(2) Select the edit number



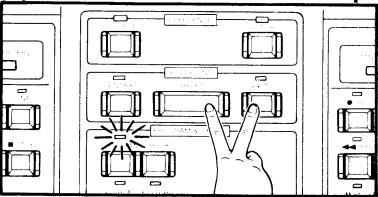
Use the Numeric Keyboard to select the edit number of the program to be cancelled.

(3) Cancellation of edit-start point



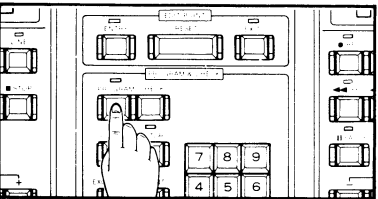
Press the Entry Button [ENTRY] and the Reset Button [RESET] at the same time. The edit-start point of the program will then be cancelled. (Check to be sure that the Entry Lamp is not illuminated.)

(4) Cancellation of edit-end point



Press the Exit Button [EXIT] and the Reset Button [RESET] at the same time. The edit-end point of the program will then be cancelled. (Check to be sure that the Exit Lamp is not illuminated.)

(5) Finish the partial program cancellation

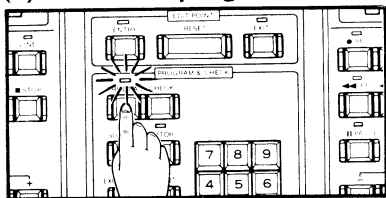


When the partial program cancellation is finished, press the Program Button [PROGRAM]. The Program Lamp will be extinguished.

■ Complete Program Cancellation

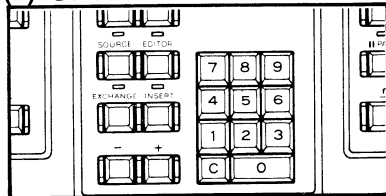
If it is desired, before editing, to cancel all entered programs, follow the steps below.

(1) Press the program button



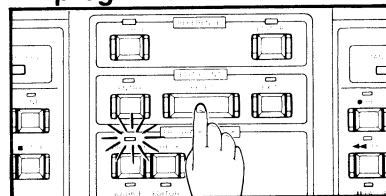
Press the Program Button [PROGRAM]. (Check to be sure that the Program Lamp is illuminated.)

(2) Select the edit number to "99"



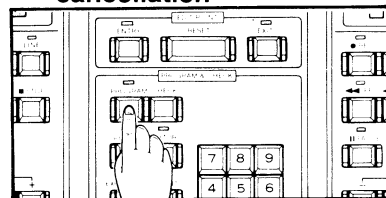
Use the Numeric Keyboard to select edit number "99". The Counter Displays of the playback unit side and the editor unit side show "0" indication.

(3) Cancellation of all entered programs



Press the Reset Button [RESET].
All entered programs are cancelled.
The Edit Number Display will show "0" indication.

(4) Finish the complete program cancellation



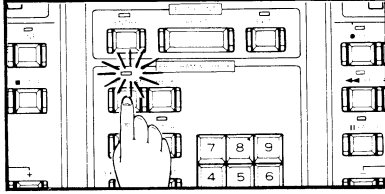
When the complete program cancellation is finished, press the Program Button [PROGRAM].
The Program Lamp will be extinguished.

When the new programmable editing is desired after the preprogrammed editing has been completed, erase the previously programmed edit in the way above described. And perform programming again.

■ Changing Program Order

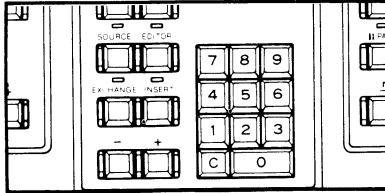
Follow the steps below in order to change the order of the entered edit programs.

(1) Pressing the program button



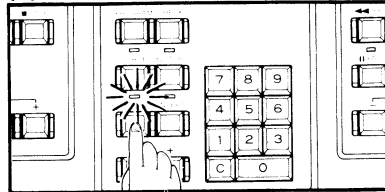
Press the Program Keyboard [PROGRAM]. Check that the Program Lamp is illuminated.

(2) Enter the edit number



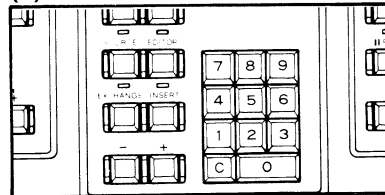
Use the Numeric Keyboard to select the first of the edit numbers to be exchanged.

(3) Press the exchange button



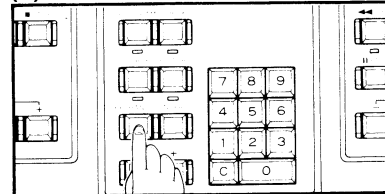
Press the Exchange Button [EXCHANGE]. Check that the Exchange Lamp is illuminated.

(4) Enter the edit number



Use the Numeric Keyboard to select the remaining edit number.

(5) Press the exchange button

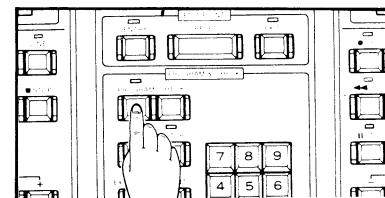


Press the Exchange Button [EXCHANGE]. Check that the Exchange Lamp is not illuminated.

(6) Subsequent changes

If there are still more changes of edit program order to be made, repeat the above steps (2)~(5).

(7) Finish the changing program order



When the changing program order is finished, press the Program Button [PROGRAM].
The Program Lamp will be extinguished.

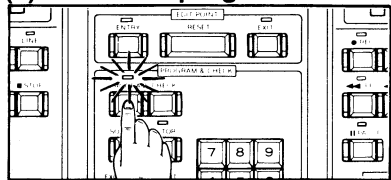
(8) Confirmation

If desired, recheck the programmed edits in the check mode previously described.

■ Insertion Of A New Programmed Edit Between Edits

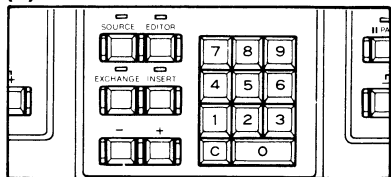
Follow the steps below to insert a new edit between two entered Programmed edits.

(1) Press the program button



Press the Program Button [PROGRAM]. Be sure that the Program Lamp is illuminated.

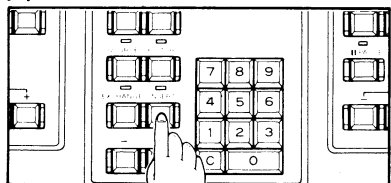
(2) Set the edit number



Use the Numeric Keyboard to select the edit number of the programmed edit immediately preceding.

If, for example, a new program is to be inserted between edit numbers "8" and "9", use the Numeric Button to select "9". A new programmed number is "9".

(3) Press the insert button



Press the Insert Button [INSERT].

The Insert Lamp will illuminate for about one second.

(4) Enter the new program by following the procedure described on page 178~179 (NUMERIC BUTTON operation), or page 207~210 (SEARCH DIAL operation).

Each of the subsequent programs will thus be moved forward.

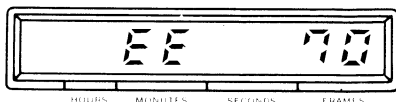
Check to be sure that the total number of Programmed edits does not exceed 20.

(5) Finish the insertion of a new programmed edit

When the insertion of a new edit between edits, press the Program Button [PROGRAM].

The Program Lamp will be extinguished.

● If total programs exceed 20 . . .

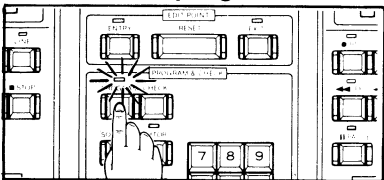


As shown in the figure at the left, the indication "EE 70" will appear in the Counter Display of the playback unit side. Programmed edits number 21 or higher will not be edited.

■ Total Lap Time

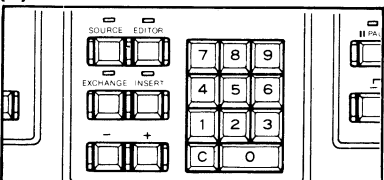
This operation is to confirm the total lap time (total required time).

(1) Press the program button



Press the Program Button [PROGRAM]. (Check to be sure that the Program Lamp is illuminated.)

(2) Set the edit number to "88"



Use the Numeric Buttons to select the edit number "88". The total lap time of the programmed edit segments will be indicated on the Editor Unit Counter Display.

(3) Finish the total lap time operation

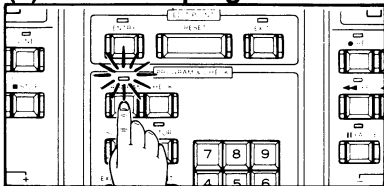
When the Lap Time review is finished, press the Program Button [PROGRAM].

The Program Lamp will be extinguished.

PREVIEW OF SPECIFIC PROGRAMS

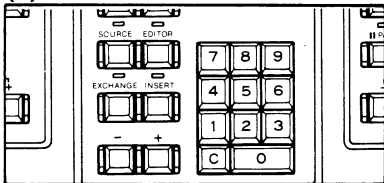
This is a “rehearsal” before editing. The segments to be edited are not actually recorded on the tape.

(1) Press the program button



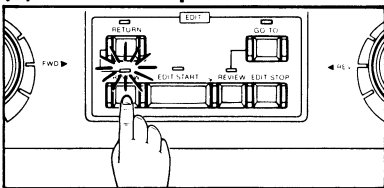
Press the Program Button [PROGRAM]. (Check to be sure that the Program Lamp is illuminated.)

(2) Set of the edit number



Use the Numeric Keyboard to select the number of the programmed edit to be previewed.

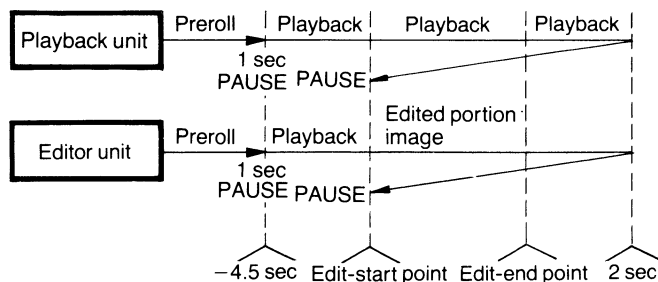
(3) Press the preview button



Press the Preview Button [PREVIEW]. The Preview Lamp will illuminate.

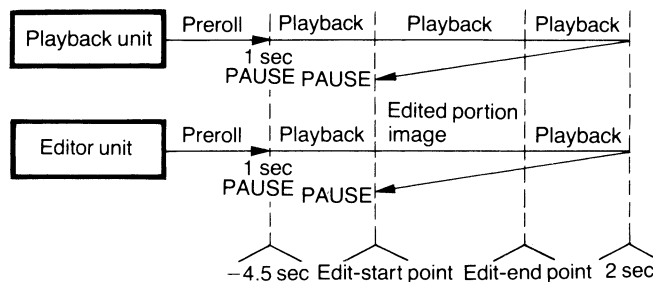
●After the Preview Button is pressed, the tape of both the playback unit and the editor unit will automatically return to a point five seconds prior to the edit-start point of the selected edit. Playback will then begin from that point at a playback speed one-fifth of ordinary speed; then, at a point 4.5 seconds prior to the edit-start point, the tape will temporarily stop in the pause condition. (This operation is called the “pre-roll” function.) After completion of edit timing alignment and a one-second pause, the playback unit and the editor unit will begin playback, and the “rehearsal” will begin from the edit-start point. After the preview operation has finished, the Preview Lamp will flash on and off.

●Assemble Editing



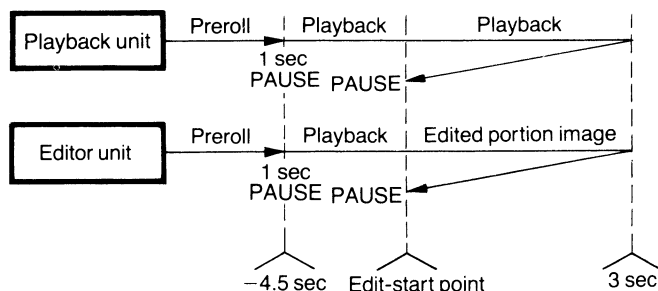
When the preview operation is conducted, the rehearsal will begin from the edit-start point, and continue to a point two seconds after the edit-end point. When the rehearsal finishes, the tape will automatically return, temporarily stopping in the pause condition at the edit-start point. When the Preview Lamp flashes, the preview operation is completed.

●Insert Editing



When the preview operation is conducted, the rehearsal will begin from the edit-start point, and will finish at the edit-end point. The tape in the playback unit and the editor unit will, however, continue playback for two seconds beyond the edit-end point. After two seconds, the tape will automatically return, and subsequent movement is the same as for assemble editing.

●Editing with No Entered Edit-End Point

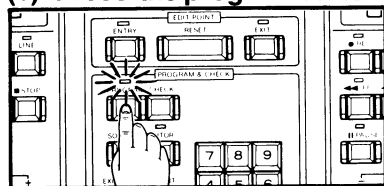


When a preview is performed, the tape will move to a point 3 seconds beyond the edit-start point. From that point, they will automatically return to the edit-start point, and remain there in the pause mode. The Preview Lamp flash on and off to indicate that the preview operation has been completed.

EDITING

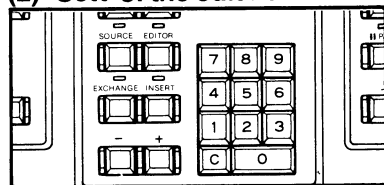
This is the actual editing operation. The entered programmed edits will be automatically edited according to the edit numbers.

(1) Press the program button



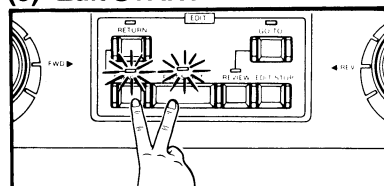
Press the Program Button (PROGRAM).
Check that the Program Lamp is illuminated.

(2) Set of the edit number



Use the Numeric Keyboard to select the edit number of the edit to be performed.

(3) Edit START

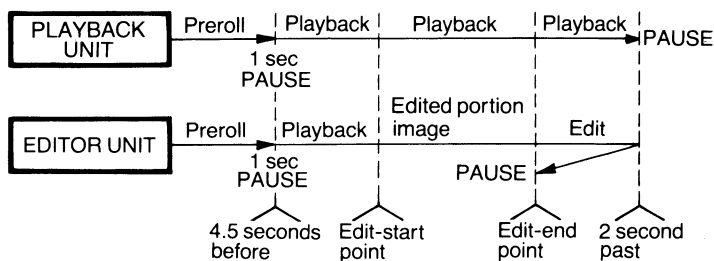


Press the Preview Button [PREVIEW] and the Edit-Start Button [EDIT START] at the same time. The Edit-Start Lamp will illuminate.

●Tape movement after Preview Button and Edit-Start Button are pressed simultaneously:

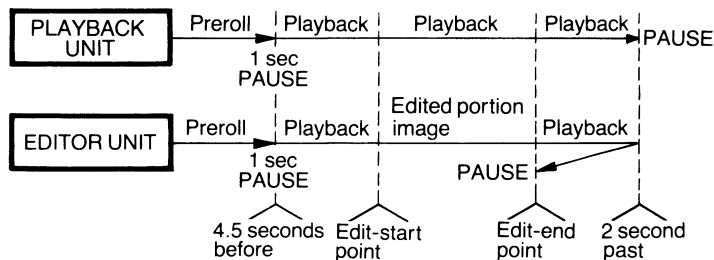
The tape in the playback unit and in the editor unit begin the pre-roll operation. When the edit-start point is reached, the editing begins. When the editing is completed, the Edit-Start Lamp begins to flash. Note that assemble editing and insert editing have different functions as described below.

●Assemble Editing



The edit begins from the edit-start point, and continues to a point two seconds after the edit-end point. After two seconds, the playback unit will go into the pause condition. (The Pause Lamp of the playback unit illuminate.) The tape in the editor unit will return to the edit-end point, and the editor unit will go into the pause condition. When the Edit-Start Lamp flashes on and off, the editing is finished.

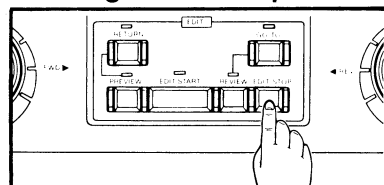
●Insert Editing



The edit begins from the edit-start point, and automatically ends at the edit-end point. The tape in the playback unit and in the editor unit continue playback for two seconds after the edit-end point. After two seconds, the tape will subsequently move in the same way as for assemble editing (described above).

●Unscheduled Editor Stop

Pressing the edit-stop button



Press the Edit-Stop Button [EDIT STOP]. The point at which the button is pressed will be the edit-end point.

●Tape movement after Edit-Stop Button is pressed:

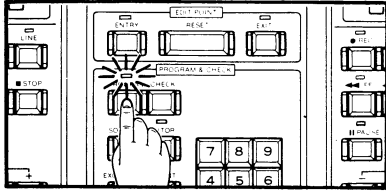
Assemble editing and insert editing have different functions.

For detailed information, read the explanation concerning the edit-end point and thereafter (on this page).

RETURN TO SPECIFIC PROGRAMS

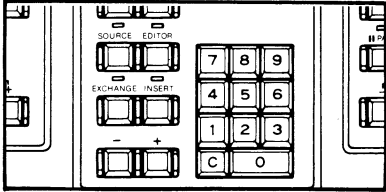
To return to the edit-start point of a specific program, follow the steps described below.

(1) Press the program button



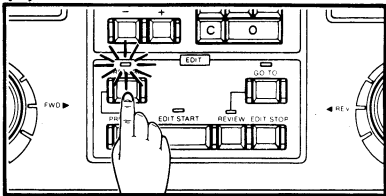
Press the Program Button [PROGRAM]. Be sure that the Program Lamp is illuminated.

(2) Set the edit number



Use the Numeric Keyboard to select the edit number to whose pre-programmed edit Start point the tape will return.

(4) Press the return button



Press the Return Button [RETURN]. The Return Lamp will then illuminate.

●Tape movement after the Return Button is pressed:

Before editing:

The tape in the playback unit and in the editor unit will return to the edit-start point, and the units will change to the pause condition.

After editing:

The tape in the editor unit will return to the edit-start point, and the unit will change to the pause mode.

When the Return Lamp flashes on and off, the return operation is finished.

Convenient uses of the return operation:

- (1) To return the tape to the edit-start point when the Search Dial has been used to enter the edit point.
- (2) To return the tape to the edit-start point during a preview of a specific programmed edit.
- (3) To return the tape to the edit-start point of a specific program after completion of editing.

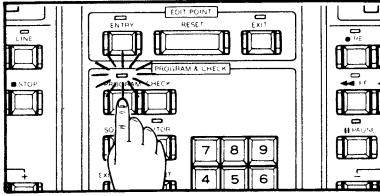
Note:

After the return operation is finished, the “go-to” operation can be started by pressing the Go-To Button. Use this button to move the tape from the edit-start point to the edit-end point.

“GO-TO” OPERATION FOR SPECIFIC PROGRAMS

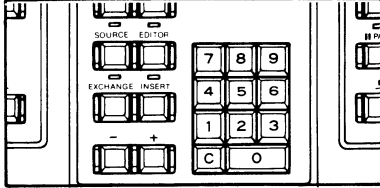
To move the tape to the edit-end point of a specific programmed edit, follow the steps described below.

(1) Press the program button



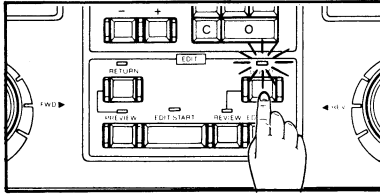
Press the Program Button [PROGRAM]. Be sure that the Program Lamp is illuminated.

(2) Set of the edit number



Use the Numeric Keyboard to select the edit number to whose pre-programmed edit and point the tape is to be returned.

(3) Press the go-to button



Press the Go-To Button [GO TO]. The Go-To Lamp will then illuminate.

●Tape movement after the Go-To Button is pressed:

Before editing:

The tape which is the edit reference video (for which the edit-end point was entered) will be wound to the edit-end point. The unit then changes to the pause condition.

After editing:

The edited tape will be wound to the edit-end point, and the unit then changes to the pause condition.

When the Go-To Lamp flashes on and off, the go-to operation is finished.

●Convenient uses of the “go-to” operation:

- (1) To wind the tape to the edit-end point during the preview operation.
- (2) To wind the tape to the edit-end point during the review operation.

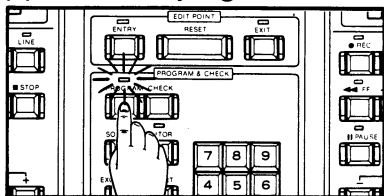
Note:

If the Return Button is pressed after the “go-to” operation is finished, the return operation will begin. To return the tape from the edit-end point to the edit-start point, press the Return Button.

REVIEW OF SPECIFIC PROGRAMS

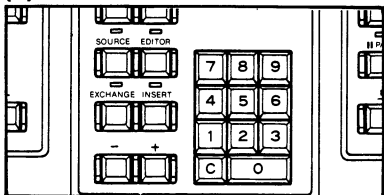
To check the edited tape, follow the steps described below.

(1) Press the program button



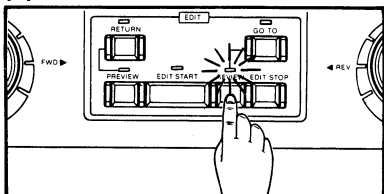
Press the Program Button [PROGRAM]. Check that the Program Lamp is illuminated.

(2) Set the edit number



Use the Numeric Keyboard to select the edit number of the program to be reviewed.

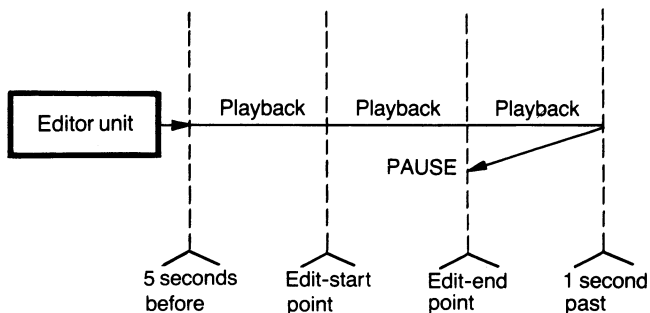
(3) Press the review button



Press the Review Button [REVIEW]. The Review Lamp will illuminate.

●Tape movement after the Review Button is pressed:

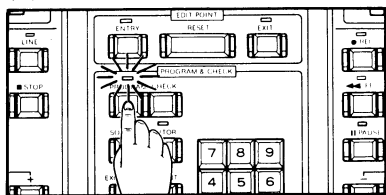
The tape on which the editing of the program has been completed will return to a point five seconds before the edit-start point of the selected programmed edit number. Then the playback of the specified program will begin from that point. After the tape passes the edit-end point plus one second, it will return to the edit-end point, and the unit will change to the pause condition. When the Review Lamp flashes on and off, the review operation is finished.



TIME-CODE ADDRESS SEARCH

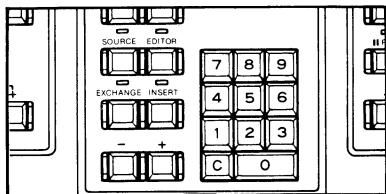
To shift the tape to a specific time-code address, follow the steps described below.

(1) Press the program button



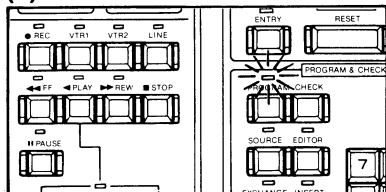
Press the Program Button [PROGRAM]. (Check to be sure that the Program Lamp is illuminated.)

(2) Set of the edit number to "55"



Use the Numeric Keyboard to select the "55" edit number.

(3) Selection of the video unit



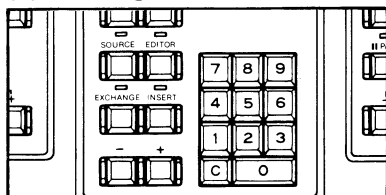
Select VTR (Playback Unit or Editor Unit) to be used for the search operation by pressing the Source or Editor Button.

●When the Source Button is pressed . . .

Select VTR 1 or VTR 2 by pressing the Playback Unit-1 Button [VTR 1] or the Playback Unit-2 Button [VTR 2].

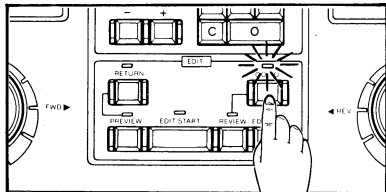
Note that the search operation cannot be made if the LINE button is pressed.

(4) Setting of the time-code



Use the Numeric Keyboard to select the desired time-code. The selected time-code will be indicated by the Counter Display.

(5) Press the "go-to" button



Press the "Go-To" Button [GO TO]. The "Go-To" Lamp will illuminate.

●Tape movement after the "Go-To" Button is pressed:

The tape of the playback unit or the editor unit will mode and pause at the selected time-code address. When the "Go-To" Lamp flashes on and off, the search operation is finished.

TO USE THE SEARCH DIAL FOR EDITING

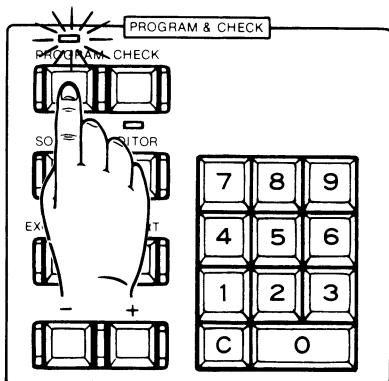
For program editing by means of TIME CODE signals, make sure the followings.

To begin the operation, playback a recorded tape on the video cassette recorder. After confirming that the time-code signal is recorded on the tape, programmed-editing may be performed.

If the programmed-editing is done in the assembly mode, a blank tape or a tape with unwanted material recorded on it should be used for the assembly mode in the editor unit. Refer to page 209 for information concerning assemble editing. Before editing, the following basic operations should first be mastered.

■ SETTING THE EDIT NUMBER

The AU-A70 Automatic Editing Controller can be used for pre-programming a maximum of 20. For programmed-editing using the time-code, set the edit number as described below.



- (1) Press the Program Button [PROGRAM]. Check that the Program Number Lamp is illuminated.
- (2) Use the Numeric Keyboard to select the number of the programmed edited. The edit number indication will be shown by the Edit Number Display [EDIT NO].

If an error is made when selecting the edit number, the display can be cleared by pressing the "C" Button. Then press the correct Numeric Buttons.

■ SELECTION OF EDITING MODE [EDIT MODE] AND EDITING REFERENCE [REFERENCE]

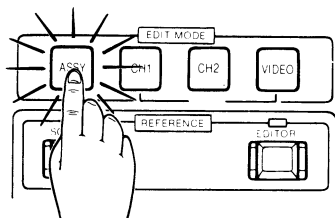
The "editing mode" refers to the two editing methods; assembly editing or insert-editing. The "editing reference" refers to the establishment of the beginning and ending edit points of the tape. If these edit points are selected on the playback unit side of the Editing Controller, this is termed the "playback unit reference". If these points are selected on the editor unit side, this is termed the "editor unit reference".

Assemble editing is usually the piecing together of opened program segments. Therefore, the editor side cannot be relied upon to have continuous CTL pulses or TIME CODE signals present on tape, and the source tape must be the edit point reference. In assembly, the editor reference select button is disabled.

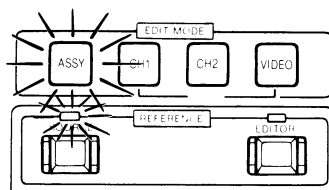
In the insert mode, where it is known that both tapes have CTL pulses or TIME CODE signals for the duration of the edit sequence, either can serve as the reference at the operator's discretion, depending on the timing importance of either the insert or the original.

● ASSEMBLE-EDITING

- (1) Press the Assembly Button [ASSY]



- (2) The Source Lamp will then automatically illuminate.



PLAYBACK UNIT
REFERENCE

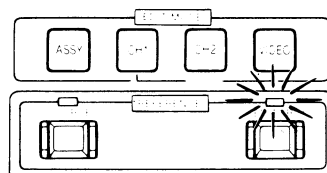
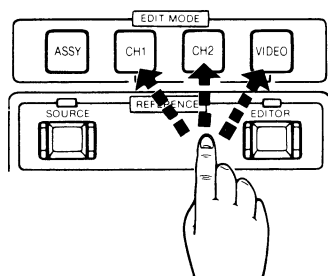
●INSERT-EDITING

The Audio CH-1 Button, Audio CH-2 Button and Video Button are used in combination for insert-editing.

COMBINATION	INSERT-EDIT
ONE SIGNAL	CH-1, CH-2, or VIDEO
TWO SIGNALS	CH-1+CH-2, CH-1+ VIDEO, or CH-2+VIDEO
THREE SIGNALS	CH-1+CH-2+VIDEO

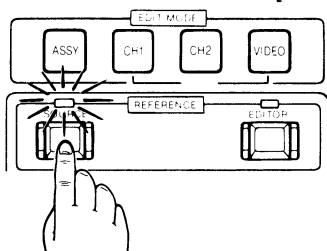
(1) Combine CH-1, CH-2 and VIDEO by pressing all three buttons.

(2) The Editor Lamp automatically illuminated.



EDITOR UNIT
REFERENCE

(3) If desired, the playback unit can be used as the editing reference. To do so, press the Source Button [SOURCE].



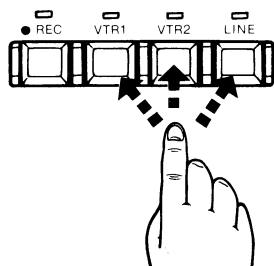
PLAYBACK UNIT
REFERENCE

Notes:

- If the CH-1, CH-2 and Video Buttons are pressed after pressing the Assembly Button, the unit will change to insert-editing.
- If the Assembly Button is pressed after pressing the CH-1, CH-2 and Video Buttons, the unit will change to assemble-editing.
- The appropriate lamp will illuminate when any of these buttons is pressed.

■ SELECTION OF PLAYBACK UNIT

To select one of the connected playback units or line, follow the steps described below.



To use playback unit-1, press the Playback Unit-1 Button [VTR 1].
To use playback unit-2, press the Playback Unit-2 Button [VTR 2].
To use line, press the Line Button [LINE].

■ SEARCH OPERATION

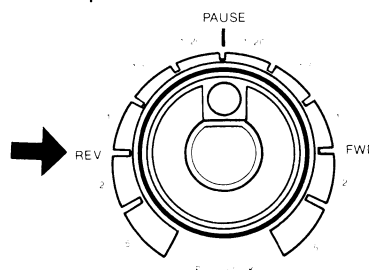
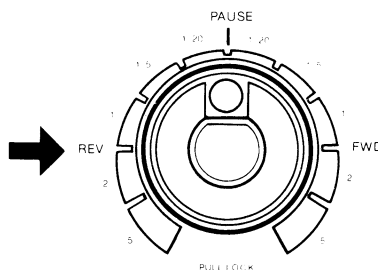
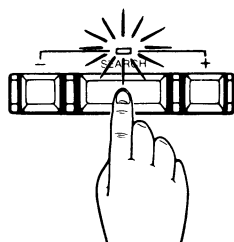
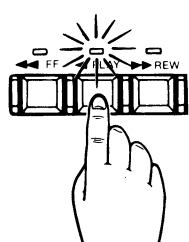
"Search operation" refers to location of edit points.

●LOCATION OF EDIT POINTS

(1) Press the Play Button [PLAY]. (2) Press the Search Button [SEARCH].

(3) While viewing the TV monitor, locate the edit points by turning the Search Dial.

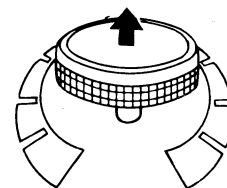
(4) When the desired edit point approaches, reduce the tape speed. At the precise edit point, turn the Search Dial to the pause [PAUSE] position.



Make certain that the Pause Lamp is illuminated.

●SEARCH DIAL LOCK

To maintain a fixed tape speed, pull the Search Dial out. The tape will then continue at the speed indicated by the center point of the dial. To cancel the lock, push the dial inward. When the dial is released, it automatically returns to the pause [PAUSE] position.



NOTES:

- If the unit is left in the pause mode for an extended length of time, damage to the tape may result. To prevent this, the machine will automatically switch from the pause mode to the stop mode if more than about ten minutes elapses.
- Bands of noise will appear during the search operation, but this is not a malfunction. The color may flicker or appear black and white. This is also normal.
- During the Search operation, only the following buttons are operable.

OPERABLE	INOPERABLE
Playback [PLAY], Rewind [REW] Fast-Forward [FF], Stop [STOP], Pause [PAUSE]	Record [REC], Edit [EDIT] Cut-in [CUT IN], Cut-out [CUT OUT]

●CORRECTION OF THE EDIT POINT (STEP-ADVANCE OPERATION)

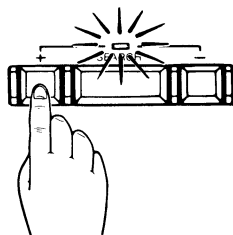
CAUTION:

This operation is only for the AU-700.

When, during still-playback in the search operation, the Step-Advance Plus Button or Step-Advance Minus Button is pressed, the image shown on the TV monitor will be advanced or retarded one field each time the appropriate button is pressed.

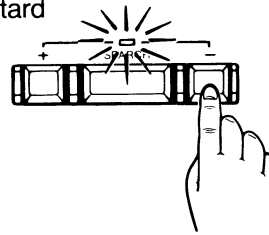
Use this function when it is desired to change very-slightly the edit point.

●Time Advance



TV image advances 1 field each time the Step-Advance Plus Button is pressed.

●Time Retard



TV image moves back 1 field each time the Step-Advance Minus Button is pressed.

■ LAL-TIME AND RESET

●Lap-time operation

- (1) Locate the edit-start point by searching, leaving the unit in the pause mode at the proper point.
- (2) Press the Entry Button.
- (3) When searching the tape on the reference unit side, the Counter Display of the reference unit will automatically change from time indication to lap-time indication.

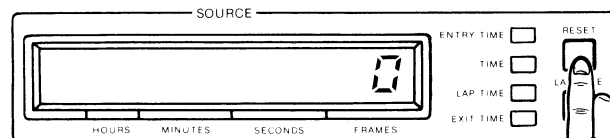
When in the programmed editing mode, the Counter Display do not change to lap-time indication. During search mode, Counter Display shows time indication. At the edit-end point, press the Lap Time Button. The lap-time will appear in the Counter Display.

- (4) If the PREVIEW, EDIT, RETURN, or GO-TO operation is initiated after the edit-end point has been entered, the Counter Display of the reference unit will automatically revert to time indication.

NOTE:

When editing with no edit-end point, entered, the above mentioned operations (except the GO-TO operation) will cause the Counter Display of the reference unit to show time indication.

●Resetting of the Counter Display (used with control signal editing)



(Illustration: Counter Display, playback unit side)

Press the Reset Button [RESET] to reset the Counter Display.

NOTES:

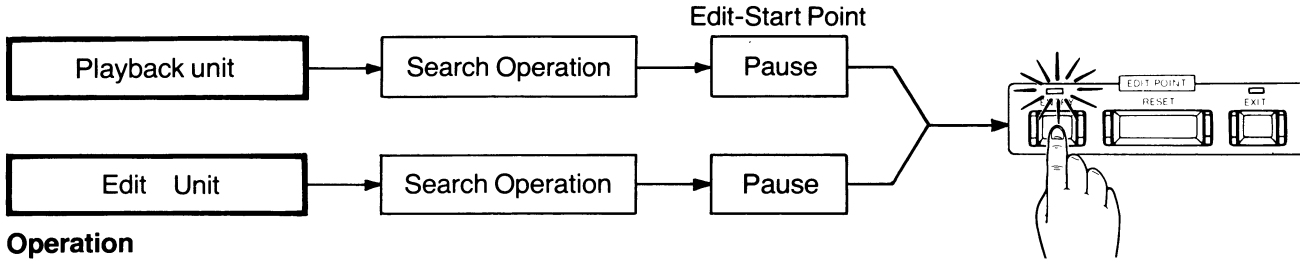
If the tape is rewound beyond the reset point, the time indication in the Counter Display will show a minus (–) indication.

If the Reset Button is pressed after the entry of edit points has finished, its entry will be erased.

■ ENTRY OF EDIT POINTS UTILIZING CONTROL TRACK AND SEARCH:

Entry of the Edit-Start Points

Enter the edit-start point in the following manner.



Operation

Playback unit side

- (1) Press the Source ⑥1 Button.
- (2) Perform search operation for playback unit.
- (3) Pause the tape at the edit-start point.
- (4) Press the Entry Button [ENTRY].

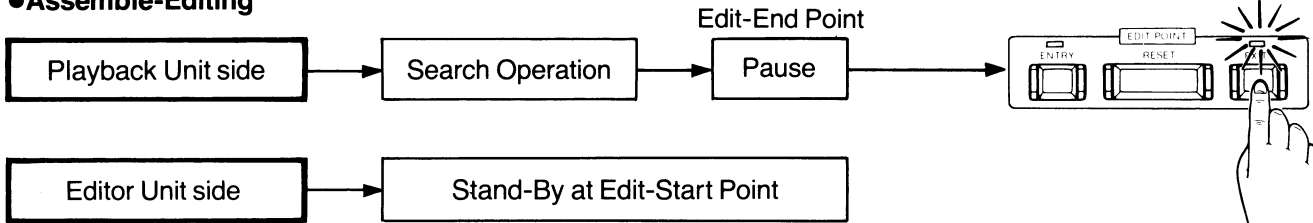
Editor unit side

- (1) Press the Editor ⑥2 Button.
- (2) Perform search operation for editor unit.
- (3) Pause the tape at the edit-start point.
- (4) Press the Entry Button [ENTRY].

Entry of the Edit-End Point

The entry of the edit-end point is done differently for assemble-editing and insert-editing.

●Assemble-Editing



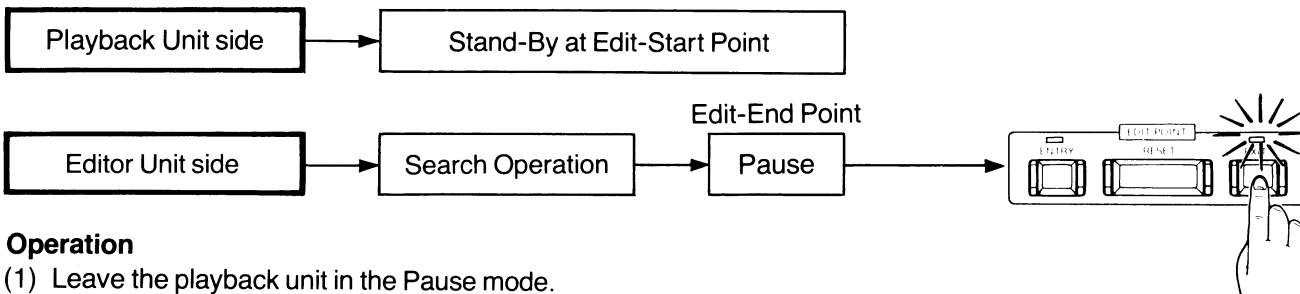
Operation

- (1) Leave the editor unit side in the pause mode at the edit-start point.
- (2) Check that the Source Lamp is illuminated. Perform the search operation for the playback unit since the reference must be the playback unit.
- (3) Pause the tape at the edit-end point.
- (4) Press the Exit Button [EXIT].
- (5) The Exit Lamp will illuminate to indicate that the entry of the edit-end point has been completed.

●Insert-Editing

For insert-editing, the editor unit is automatically selected as the reference unit. However, because the playback unit may be selected as the reference unit, select the reference desired and then enter the edit-end point (for the selected reference).

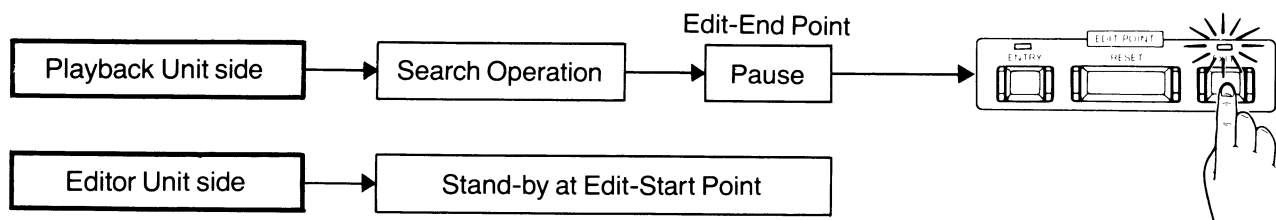
1) Editor Unit Reference



Operation

- (1) Leave the playback unit in the Pause mode.
- (2) Check that the Editor Lamp is illuminated. Perform search operation for the editor unit, assuming the editor is the reference unit.
- (3) Pause the tape at the edit-end point.
- (4) Press the Exit Button [EXIT].
- (5) The Exit Lamp will illuminate to indicate that the entry has been completed.

2) Playback Unit Reference



Operation

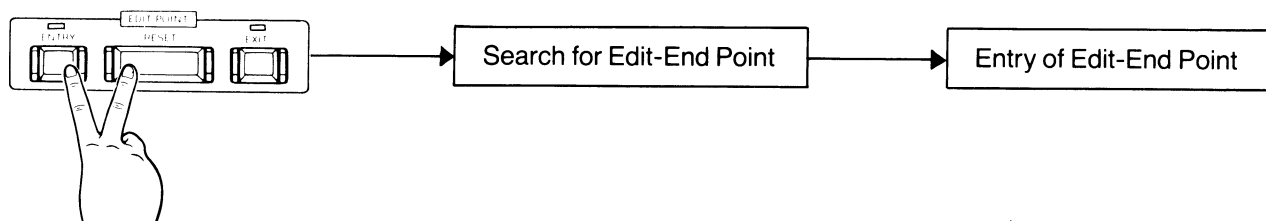
- (1) Lease the editor unit in the Pause mode.
- (2) Check that the Source Lamp is illuminated. Perform the search operation for playback unit.
- (3) Pause the tape at the edit-end point.
- (4) Press the Exit Button [EXIT].
- (5) The Exit Lamp will illuminate to indicate that the entry has been completed.

■ REVISION OF ENTERED EDIT POINT (EDIT-POINT RESET OPERATION)

To revise an already-entered edit point, perform the following edit-point reset operation.

Revision of Edit-Start Point

(To return the tape to the edit-start point, press the Return Button [RETURN]. Refer to page 198, step (4) for information concerning the return operation.)

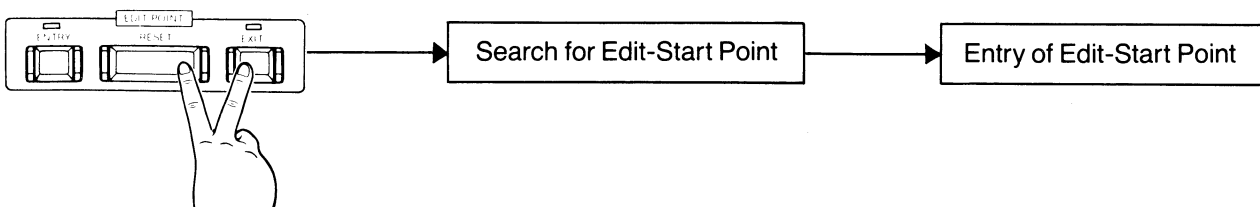


Operation

- (1) Press the Source ⑥1 or Editor ⑥2 Button to select VTR. When the Source ⑥1 Button is pressed, select playback VTR.
- (2) Press the Entry Button [ENTRY] and the Reset Button [RESET] simultaneously. This will erase the already-entered edit-start point.
- (3) Perform the search operation to locate the correct edit-start point.
- (4) Enter the edit-start point.

Revision of Edit-End Point

(To advance the tape to the edit-end point, press the Go-To Button [GO TO]. Refer to page 199, step (4) for information concerning the operation of this button.)



Operation

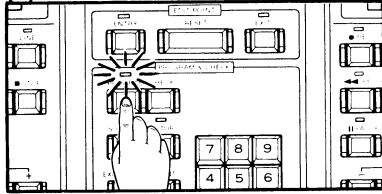
- (1) Press the Source ⑥1 or Editor ⑥2 Button to select VTR. When the Source ⑥1 Button is pressed, select playback VTR.
- (2) Press the Exit Button [EXIT] and the Reset Button [RESET] simultaneously. This will cancel the already-entered edit-end point.
- (3) Perform the search operation for the reference unit to locate correct edit-end point.
- (4) Enter the edit-end point.

NOTES:

- Perform revisions of the edit-start and edit-end points separately. If the Exit Button and the Reset Button are pressed at the same time immediately after the Entry Button and the Reset Button are pressed, the entry of both the edit-start and edit-end points can be erased.
- Editing-point revisions are made by using the time indication of the Counter Display.
If an edit point is revised immediately after being entered, be sure to reset the edit point and enter it again.

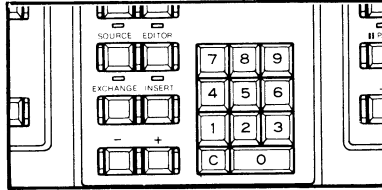
Programmed Insert Editing Utilizing Time Code and Search.

(1) Press the program button



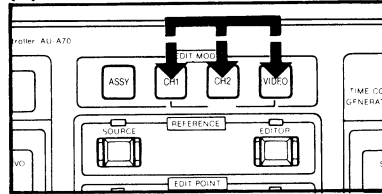
Press the Program Button [PROGRAM]. Check that the Program Lamp is illuminated.

(2) Set of the edit number



Use the Numeric Keyboard to set the edit number.

(3) Selection of editing mode



The insert editing mode is selected by choosing the CH-1, CH-2, or Video (any or all).

The CH-1 Button is for audio channel 1 only.

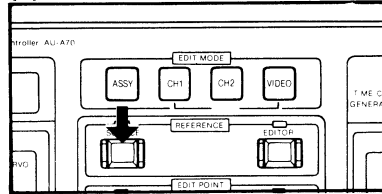
The CH-2 Button is for audio channel 2 only.

The Video Button is for the video signal only.

Note:

If the time code is recorded on tape track CH 1, the CH 1 Button should not be selected.

(4) Selection of editing reference

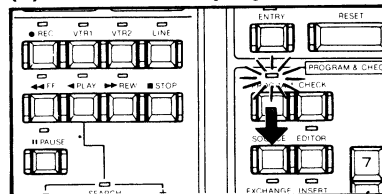


Once the insert editing mode has been selected, the editor-unit automatically becomes the reference unit.

If it is desired to use the playback unit as the reference unit, press the Source Button [SOURCE].

(See pages 202 through 203, section "EDITING REFERENCE".)

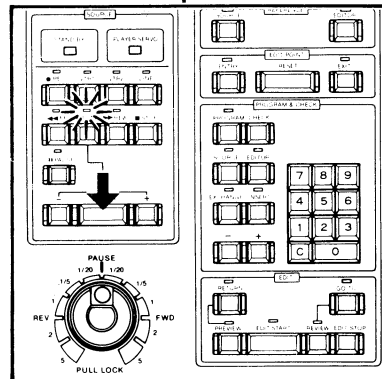
(5) Selection of playback unit



(1) Press the Source Button [SOURCE]. Check that the Source Lamp is illuminate.

(2) Press the Playback Unit-1 [VTR 1], Playback Unit-2 [VTR 2], or Line Button according to the playback unit which you desire.

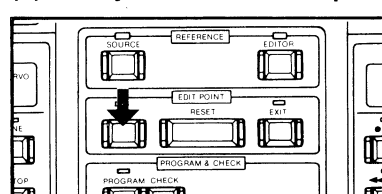
(6) Searching for the playback edit-start point



Press the playback unit Search Button [SEARCH]. While watching the image on the TV monitor, operate the Search Dial to locate the edit-start point. At that point, let the unit go to the pause mode.

When the Line Button is selected, this step is not necessary.

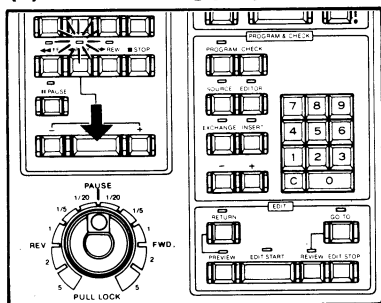
(7) Entry of the edit-start point



Press the Entry Button [ENTRY].

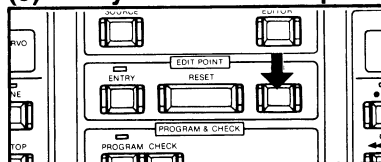
When the entry of the edit-start point has been completed, the Entry Lamp will illuminate.

(8) When using playback unit for reference



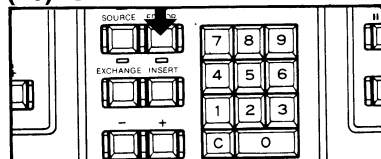
Press the Search Button [SEARCH]. While watching the image on the TV monitor, operate the Search Dial to locate the edit-end point. At that point, let the unit go to the pause mode.
When in the pre-programmed line editing mode, use numeric keyboard for the edit interval time.

(9) Entry of the edit-end point



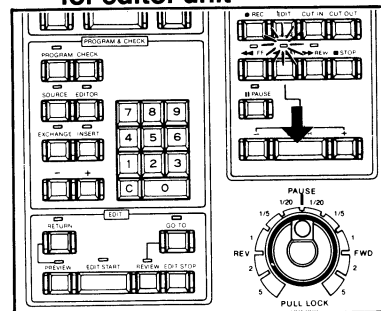
Press the Exit Button [EXIT].
When the entry of the edit-end point has been completed, the Exit Lamp will illuminate.

(10) Selection of the editor unit



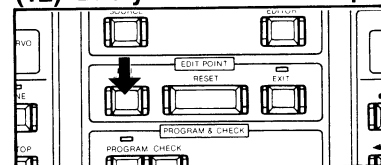
Press the Editor Button [EDITOR]. (Check to be sure that the Editor Lamp will illuminate.)

(11) Searching the edit-Start point for editor unit



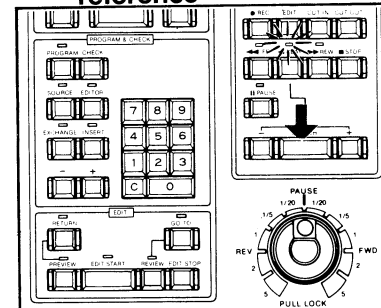
Press the Search Button [SEARCH].
While watching the image on the TV monitor, operate the Search Dial to locate the edit-start point. At that point, allow the unit to go to the pause mode.

(12) Entry of the edit-start point



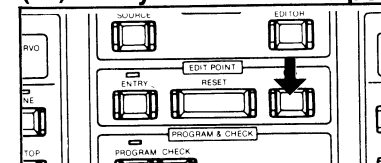
Press the Entry Button [ENTRY].
When the entry of the edit-start point has been completed, the Entry Lamp will illuminate.

(13) When using the editor unit for reference



Press the Search Button [SEARCH].
While watching the image on the TV monitor, operate the Search Dial to locate the edit-end point. At that point, let the unit go to the pause mode.

(14) Entry of the edit-end point



Press the Exit Button [EXIT].
When the entry of the edit-end point has been completed, the Exit Lamp will illuminate.

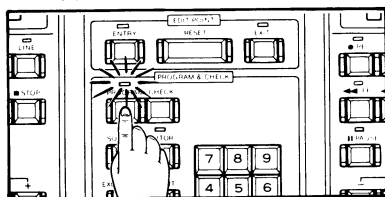
(15) Enter subsequent edit points in order using the edit number display and the program buttons.

(16) When the entry of the edit points is completed, follow the steps described on pages 190 through 201.

Programmed Assemble Editing Utilizing Time Code and Search

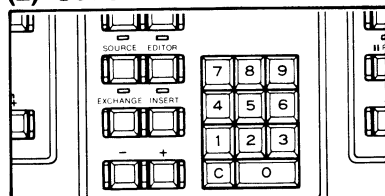
If blank tape on which no time-code signal has been recorded is inserted into the editor unit, perform program editing in the way described below.

(1) Press the program button



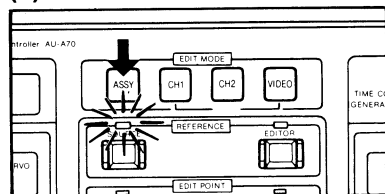
Press the Program Button [PROGRAM].
Be sure that the Program Lamp has illuminated.

(2) Set of the edit number



Use the Numeric Keyboard to set the edit number.

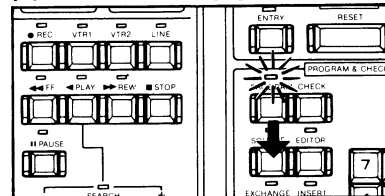
(3) Selection of the assemble



Press the Assembly Button [ASSY]. The Insert Mode (CH1 CH2 VIDEO) Buttons can not be used with a blank tape in the Editor.

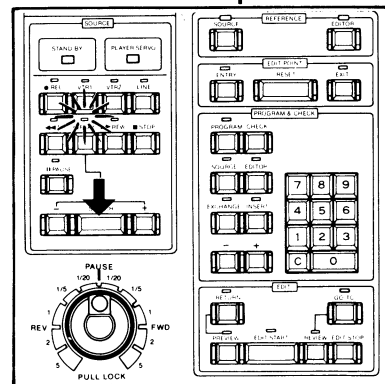
Even though the Source is automatically selected by pressing the Assemble Mode Button.
The Editor Unit cannot be used for reference.

(4) Selection of playback unit



- (1) Press the Source Button [SOURCE]. (Check to be sure that the Source Lamp will illuminate.)
- (2) Press the Playback Unit-1 [VTR 1], Playback Unit-2 [VTR 2], or Line [LINE] Button according to the playback unit desired.

(5) Search for the playback unit edit-start point



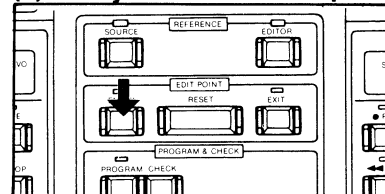
Playback unit search

Press the Search Button [SEARCH].

While watching the image on the TV monitor, operate the Search Dial to locate the edit-start point. At that point, allow the unit to go to the pause mode.

When the Line Button is selected, this step is not necessary.

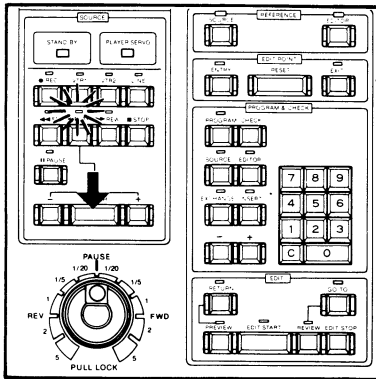
(6) Entry of the edit-start point



Press the Entry Button [ENTRY].

When the entry of the edit-start point has been completed, the Entry Lamp will illuminate.

(7) Search for the playback unit edit-end point



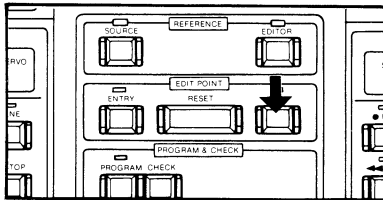
Playback unit search

Press the Search Button [SEARCH].

While watching the image on the TV monitor, operate the Search Dial to locate the edit-end point. When found, allow the unit to go to the pause mode.

When in the pre-programmed line editing mode, use numeric keyboard for the edit interval time.

(8) Entry of the edit-end point



Press the Exit Button [EXIT].

When the entry of the ending-edit point has been completed, the Exit Lamp will illuminate.

(9) Check that the Editor Unit tape is in the proper location.

Enter subsequent edit points using the edit number display and the program button.

When the entry of the edit points is completed, follow the steps described on pages 190 through 201.

●Mixed Editing with a prerecorded “black” tape

If tape, on to which continuous black-burst and time-code signals has been recorded, is inserted into the editor unit, programmed editing can be performed in the insert edit method mode, allowing selection of audio or video only edits, not possible in assemble. But be sure that the Edit Mode is INSERT, and that the Edit Reference is SOURCE side. The finish editing operation appears the same as assemble-editing.

Operation

- (1) Set the edit number.
- (2) Select the edit mode: Press the Insert Button.
- (3) Select the edit reference: Press the Source Button.
- (4) Select the Playback Unit (VTR 1/VTR 2/Line).
- (5) Search for the playback unit edit-start point.
- (6) Entry of the edit-start point.
- (7) Search for the playback unit edit-end point.
- (8) Entry of the edit-end point.
- (9) Then repeat steps (1)~(8).
- (10) When the above operation has been completed, follow the steps described on pages 190 through 201.

EDITING WHEN THE EDIT NUMBER IS “0”

When the edit number will be “0” and programmed editing cannot be made. Therefore, the following procedure must be utilized.

■ OPERATION FOR EDITING VTR-TO-VTR DUPLICATIONS INSERT EDITING

INSERT EDITING

Steps	Editing Process	Operation
1	Selection of the Insert editing mode.	Press by choosing the CH1, CH2 or Video. (any or all)
2	Selection of the editing reference.	Select editing or playback unit reference.
3	Selection of playback unit.	Press the Source Button ⑥1 of the keyboard and select either Playback unit-1 or unit-2.
4	Search and entry for edit-start point.	Operate the Search function for playback unit, and press the Entry Button.
5	When using the playback unit for reference.	Operate the Search function for playback unit.
6	Enter the edit-end point.	Press the Exit Button.
7	Selection of editor unit.	Press the Editor Button ⑥2 of the keyboard.
8	Search and entry for edit-start point.	Operate the search function for playback unit, and press the Entry Button.
9	When using the editor unit for reference.	Operate the search function for editor unit.
10	Enter the edit-end point.	Press the Exit Button.
14	If required to stop edit during insert editing.	Press the Edit Stop Button at the desired end point.
15	Review operation.	Press the Review Button.

ASSEMBLE EDITING

Steps	Editing Process	Operation
1	Selection of the Assembly editing mode.	Press the Assembly Button.
2	Selection of the editing reference.	_____
3	Selection of playback unit.	Press the Source Button of the keyboard and select either playback unit-1 or unit-2
4	Search and entry for edit-start point.	Operate the search function for playback unit, and press the Entry Button.
5	Search and entry for edit-end point.	Operate the search function for playback unit, and press the Exit Button.
6	Selection of editor unit.	Press the Editor Button of the keyboard.
7	Search and entry for edit-start point.	Operate the search function for editor unit, and press the Entry Button.
8	Editing operation is the same as the Insert Editing steps 11 through 15.	

Notes:

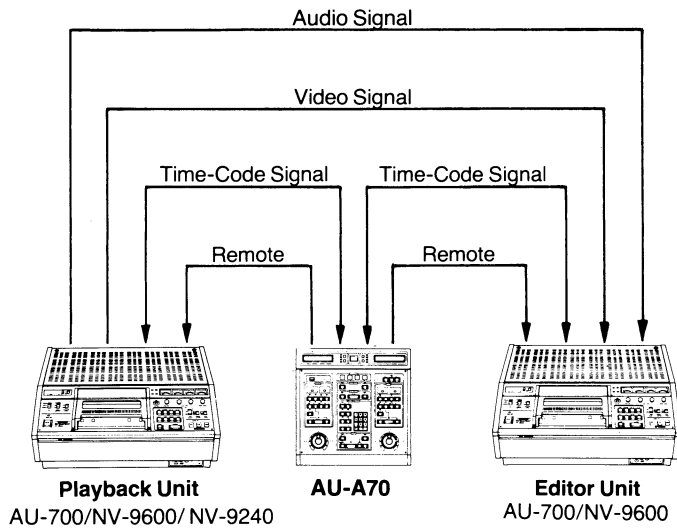
- If editing is to be continued, select the editing mode and proceed with the next edit.
- For protection of the tape, the unit will automatically switch to the stop mode if left for more than ten minutes in the pause mode.

EDITING SYSTEM COMBINATIONS BY USING ONE PLAYBACK UNIT

The Editing Controller AU-A70 can be combined, as desired, as a part of the systems illustrated below.

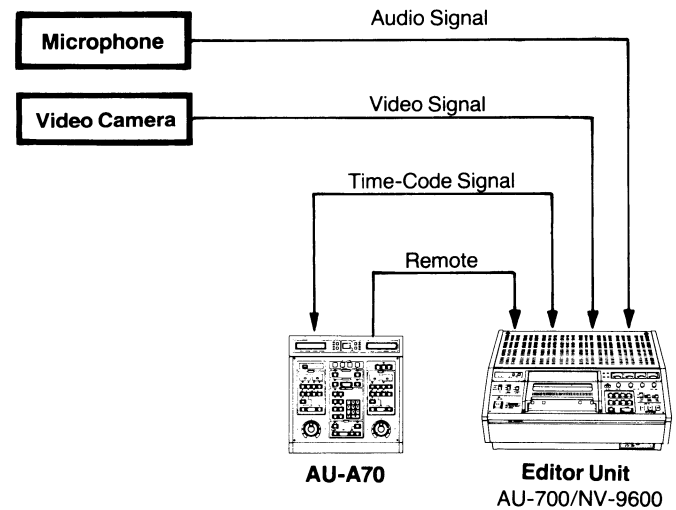
1. Basic System

This system is capable of editing for tape-to-tape recording from one Video Cassette Recorder to another.



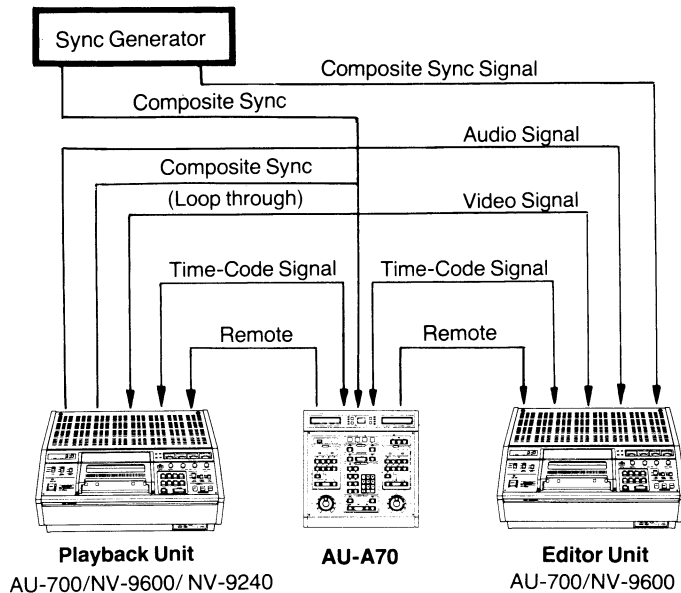
2. Remote Operation (Editing of Video Camera Signals)

This system is capable of recording video camera signals.



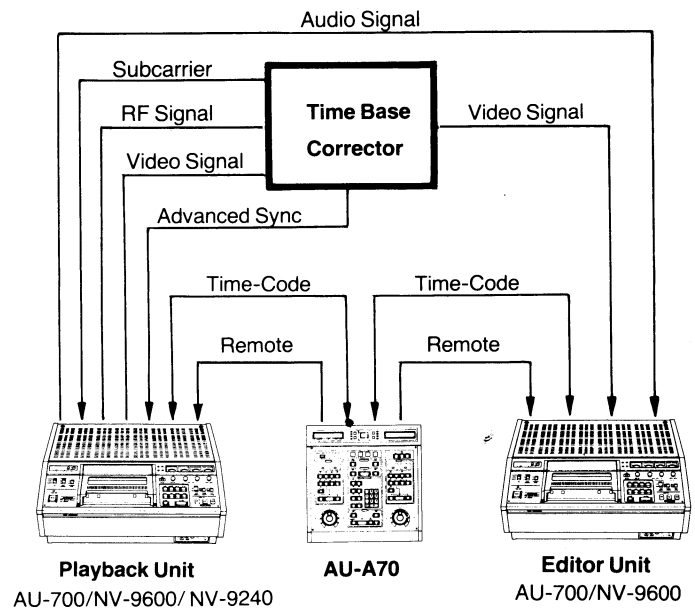
3. With External Synchronization

If a synchronizing generator is to be used for improved editing stability, the following system should be used.



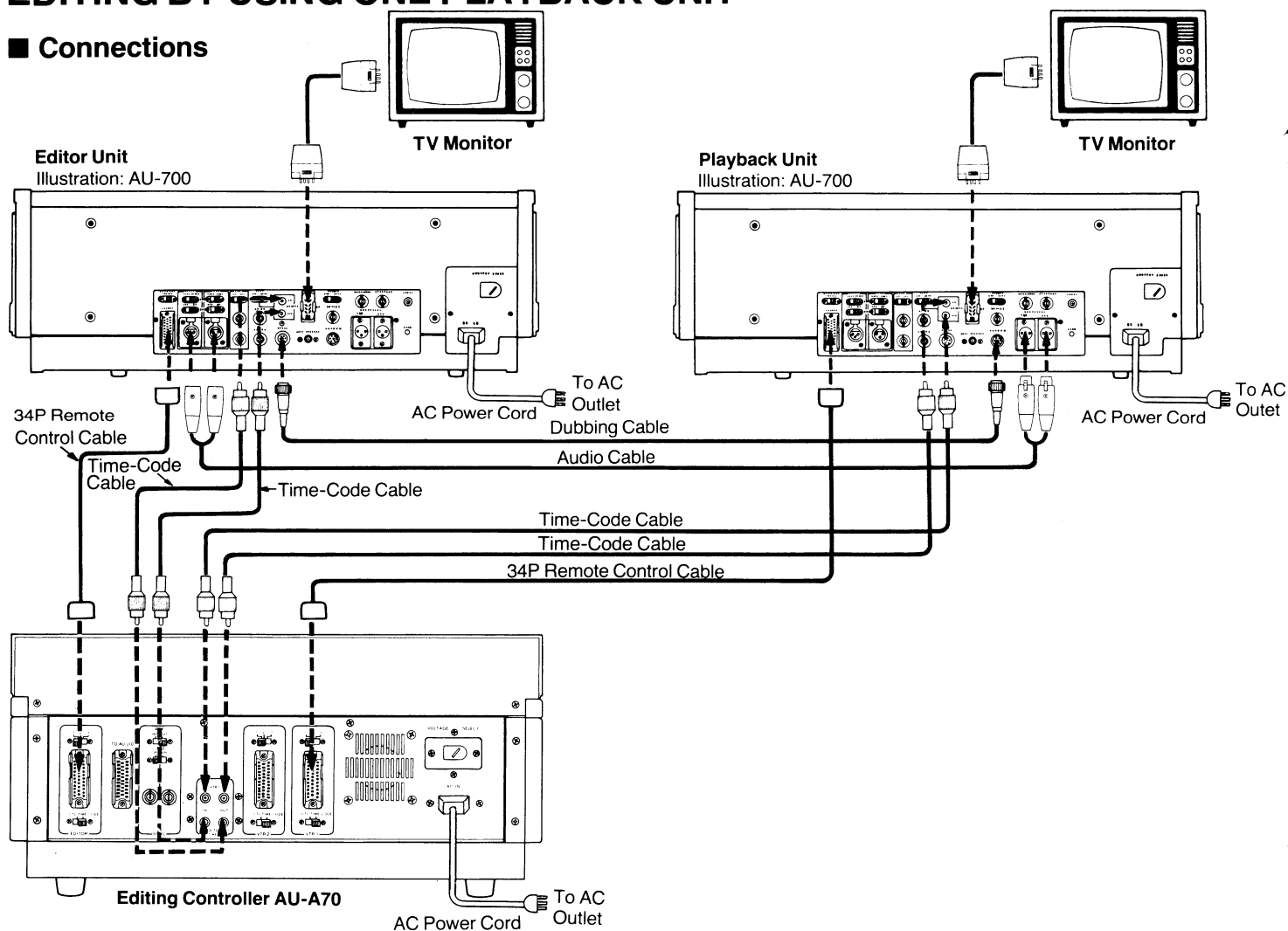
4. With Time-Base Corrector

The following system can be used to reduce "jitter" (improve time base stability) in the editing image.



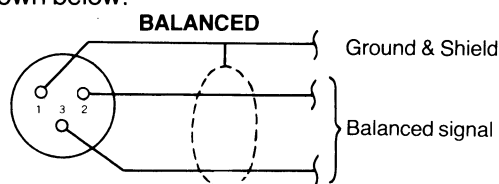
EDITING BY USING ONE PLAYBACK UNIT

■ Connections

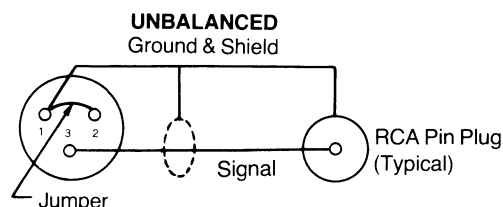


■ AUDIO CONNECTOR ADAPTATION

The AU-A70 is designed to function with either the AU-700 recorder or the NV-9240/9600 units. Since the AU-700 is equipped with balanced audio and XLR type connectors, the AU-A70 is also equipped with XLR connectors. For connection to a different recorder or other unbalanced audio device, an adaptor cable must be utilized. Wire the cable as shown below.



NOTE: In order to assure proper audio phase, wire all connectors identically.



NOTE: Pins 1 and 3 rather than 1 and 2 may be made common if this is the user's convention.

■ Audio Line Level Preselection

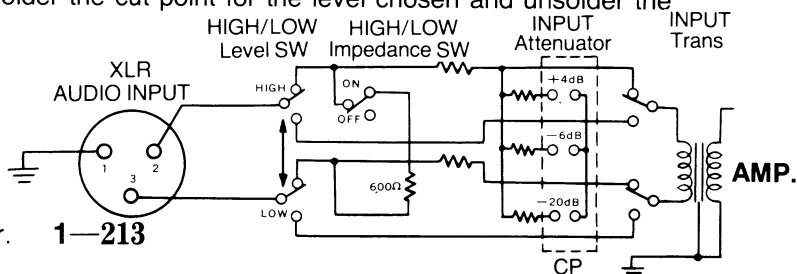
The AU-700 is supplied from the factory with the Line (high) level audio input wired for a nominal +4 dB input. This may be changed to -6 dB or -20 dB by internally soldering across different circuit board conductors called "cut points" (CP).

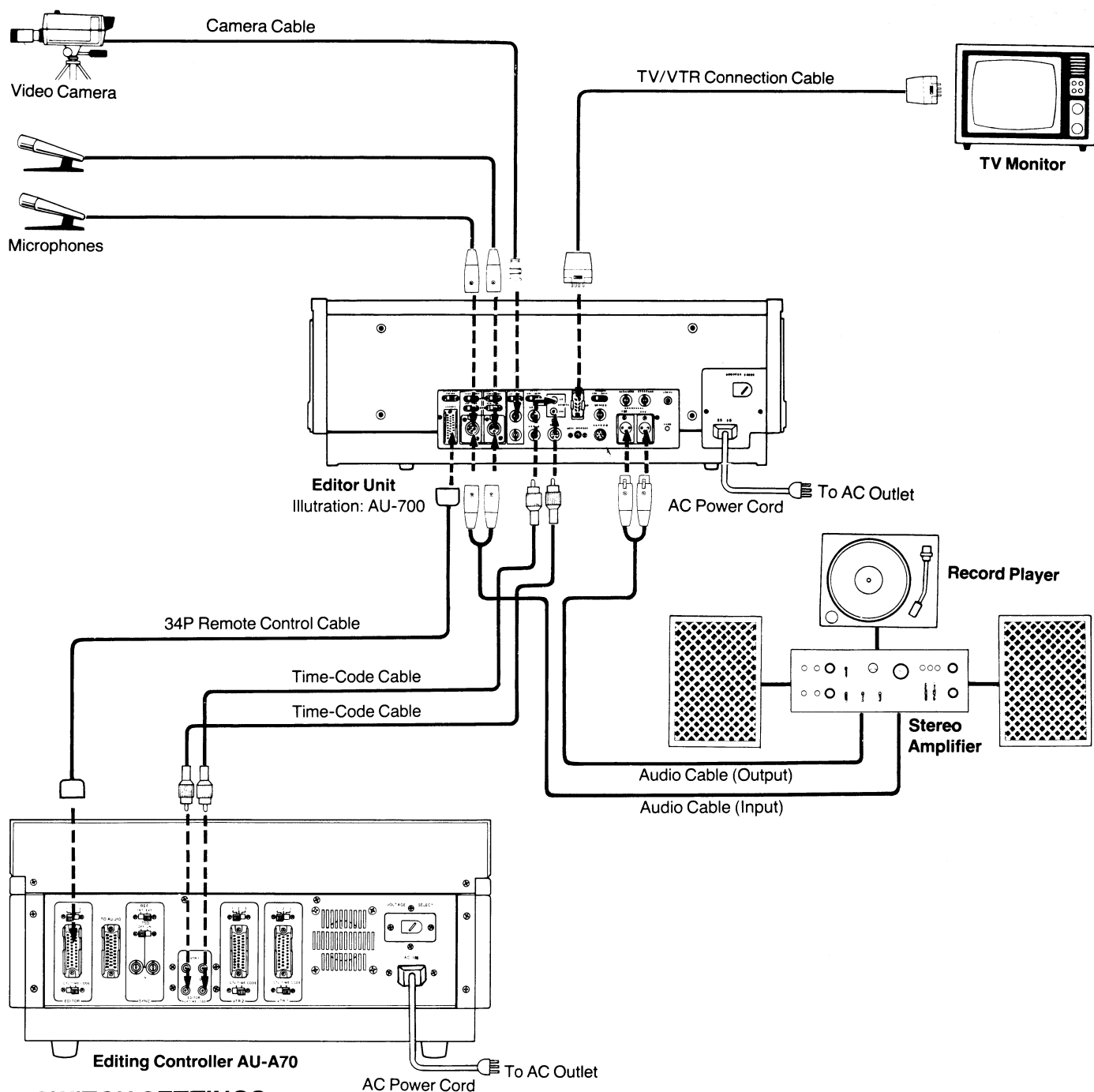
These Cut Points are located on the circuit board just behind the audio input connectors within the machine. Seek technical assistance if the location and procedure is not readily apparent.

Follow the chart and simplified schematic shown below to select the input level desired. The Low (Microphone) level input will not be affected. Solder the cut point for the level chosen and unsolder the remaining points.

INPUT LEVEL	-20 dB	-6 dB	+4 dB
Channel 1	CP1	CP2	CP3
Channel 2	CP4	CP5	CP6

For further information or assistance, refer to a Panasonic dealer or an authorized Service Center.





■ SWITCH SETTINGS

Source Playback

SWITCH	POSITION
SYNC	INTERNAL
MEMORY	OFF
INPUT	DUB
VIDEO MODE	AUTO
FRAME SERVO	OFF

Editor

SWITCH	POSITION
SYNC	NORMAL
MEMORY	OFF
INPUT	DUB
VIDEO MODE	AUTO
FRAME SERVO	ON

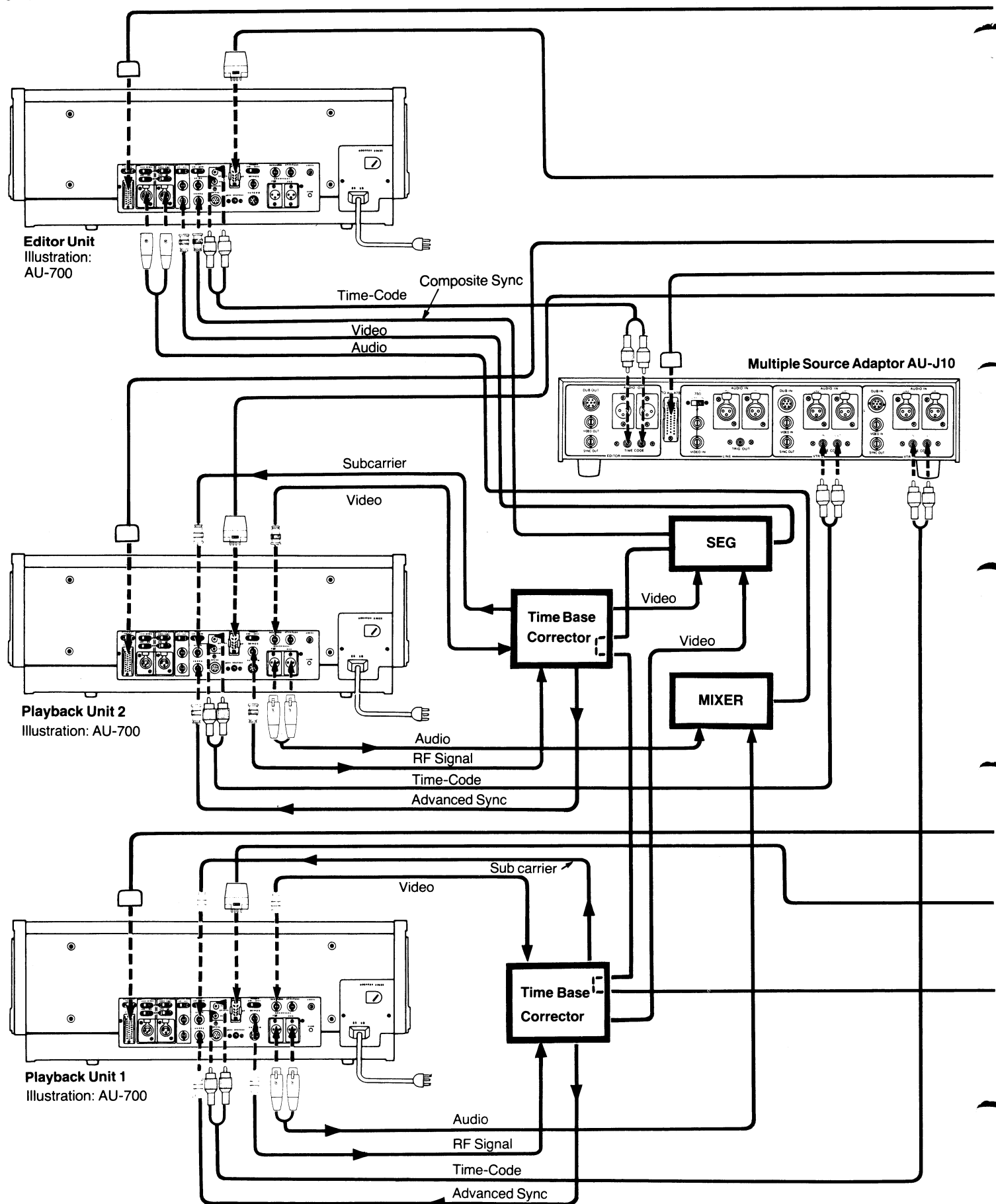
■ OPERATION

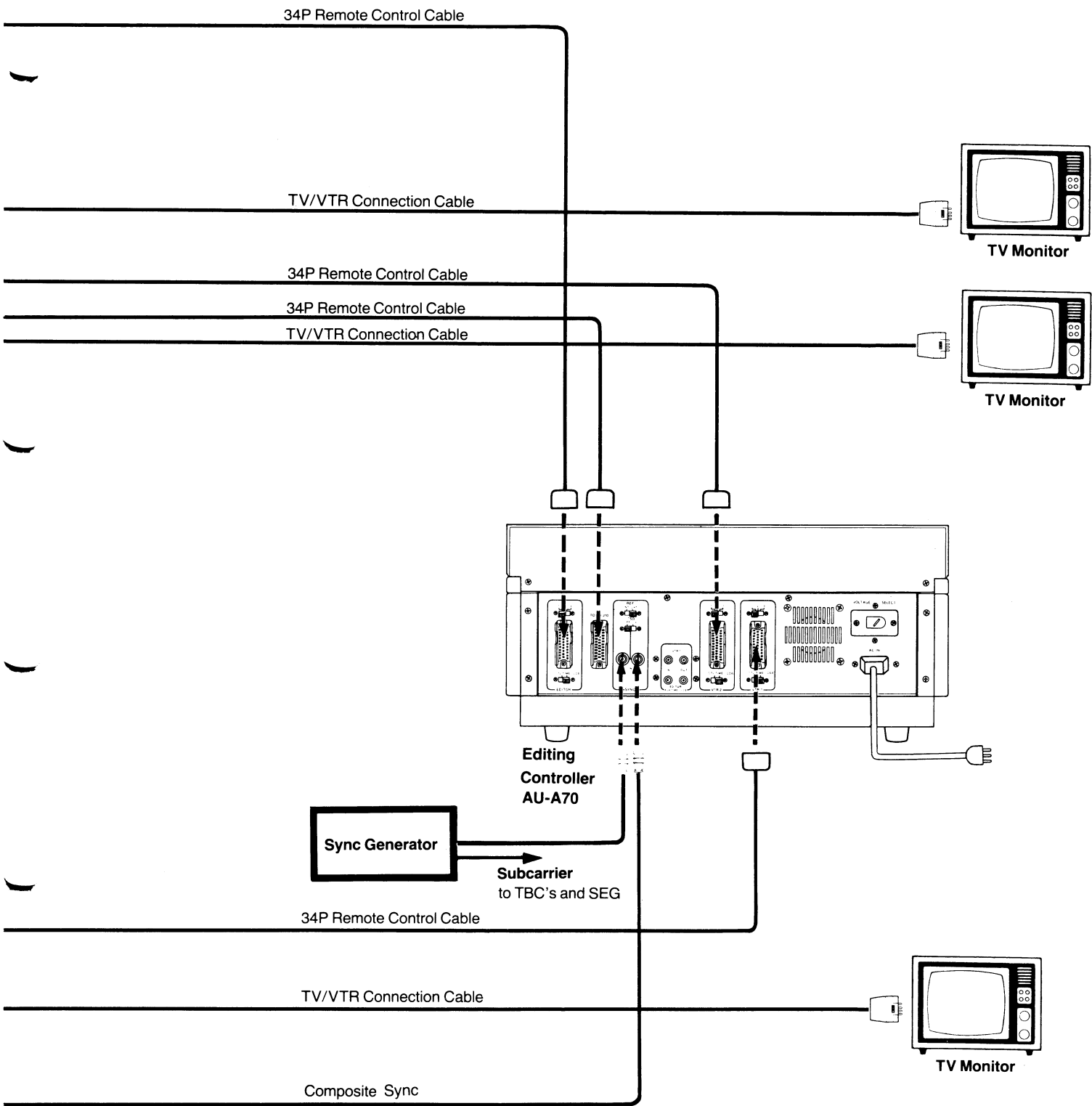
When connecting the one playback unit, make sure to select the Playback unit-1 [VTR 1]. Line [LINE] Button should be selected for camera (video) input.

- 1) For programmed editing, refer to pages 178~210.
- 2) For the editing of edit number "0", refer to page 211.

TO START 2 PLAYBACK UNITS SIMULTANEOUSLY

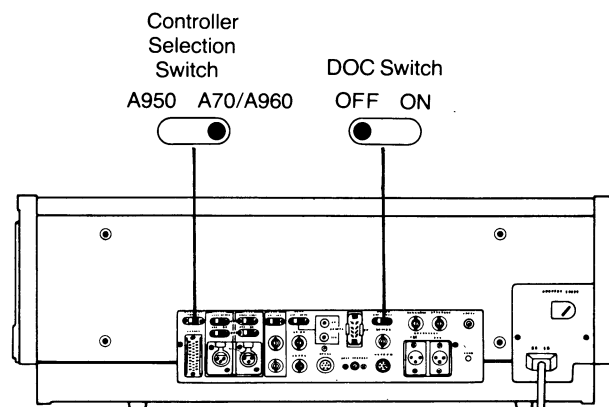
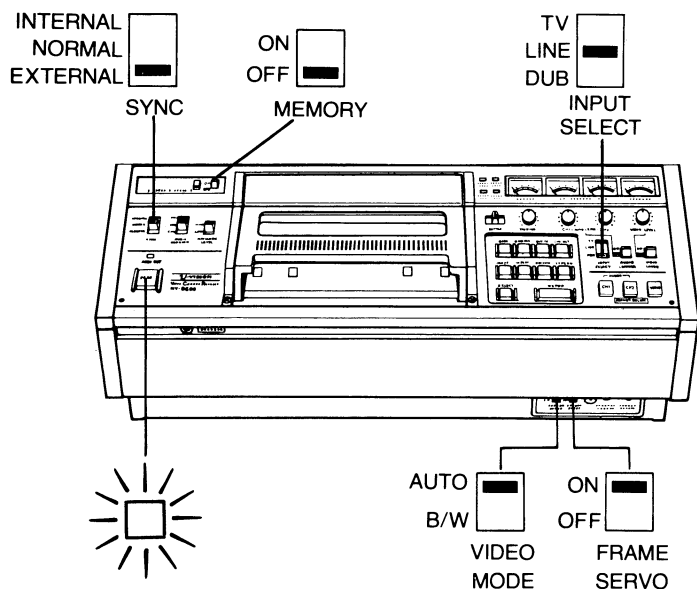
To start two playback units simultaneously in order to edit while utilizing a special Effects Generator for post-production effects make the connections as shown in the figure below.



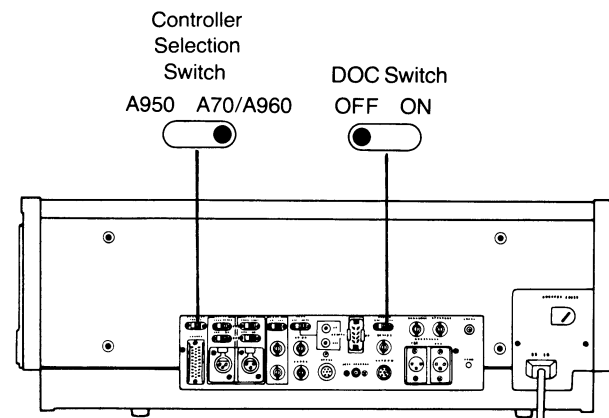
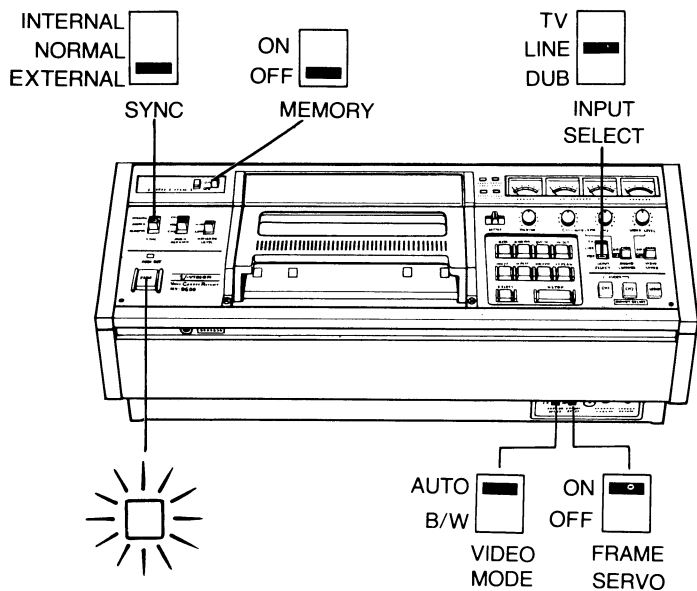


■ SWITCH SETTINGS FOR DUAL PLAYBACK WITH TBC's AND SEG

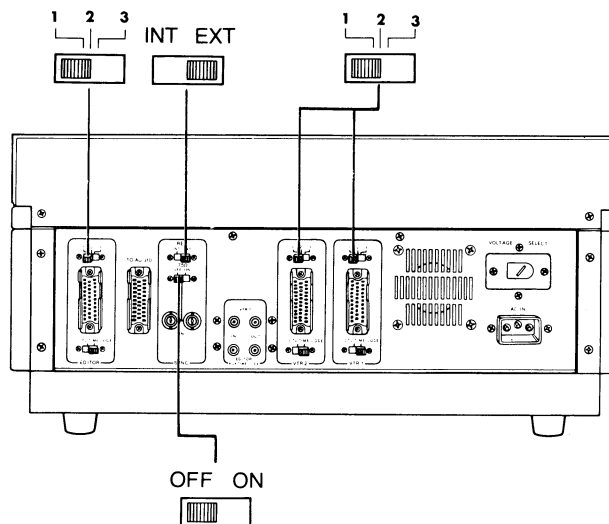
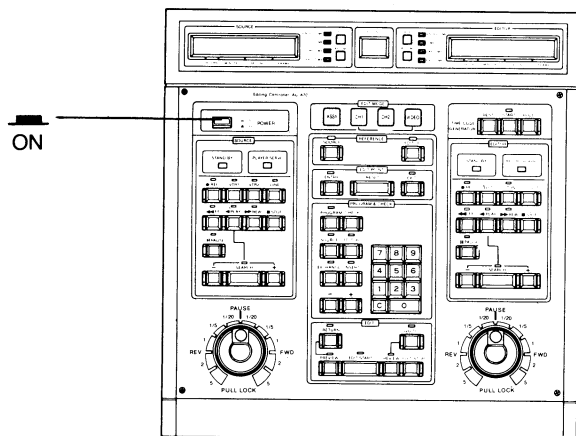
● Playback unit switch settings



● Editor switch settings



● Editing controller (AU-A70) switch settings



■ OPERATION

(1) Select the VTR's edit-start point

- When using the time-code address search

See page 201.

- When using the search dial operation

(A) Selection of playback unit

Press the Playback Unit-1 [VTR 1] or Playback Unit-2 [VTR 2] Button.

(B) Search for the playback edit-start point

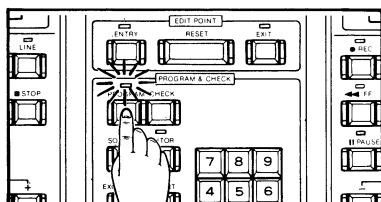
Press the playback unit Search Button [SEARCH] during playback. While watching the image on the TV monitor, operate the Search Dial to locate the edit-start point. At that point, let the unit go to the pause mode.

(C) Repeat above steps (B (and (C) for another playback unit.

(D) Search for the editor edit-start point

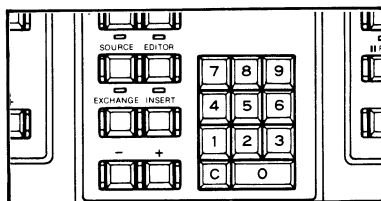
Press the Search Button [SEARCH] during playback. While watching the image on the TV monitor, operate the Search Dial to locate the editstart point. At that point, allow the unit to go to the pause mode.

(2) Press the program button



Press the Program Button [PROGRAM]. Check that the Program Lamp is illuminated.

(3) Set the edit number to "77"



- Use the Numeric Keyboard to select the edit number "77". Edit number "77" indicates a simultaneous start of two playback units is to be entered.

(4) Selection of a editing mode

Press the Assembly Button or Insert Button according to the desired editing mode.

(5) Select the edit reference

- When assemble editing mode has been selected, the source-unit automatically becomes the reference unit.
- Once insert editing mode has been selected, the editor-unit automatically becomes the reference unit.
When it is desired to use the playback unit as the reference unit, press the Source Button [SOURCE].

(6) Entry of playback unit edit-start point

After pressing the Source Button (61), press the Entry Button. Entry Lamp illuminates.

(7) Entry of editor edit-start point

After pressing the Editor Button (62), press the Entry Button. Entry Lamp illuminates.

(8) If required, select and enter the reference unit edit-end point

Select the reference VTR's edit-end point in the same way as step (1), and press the Exit Button.

Note:

When the source reference is selected, playback unit should be the same VTR as the lamp illuminates on the playback unit side.

(9) Editing

Press the Preview Button [PREVIEW] and the Edit-Start Button [EDIT START] at the same time. The Edit-Start Lamp will illuminate.

Note that the Preview function can also be performed before editing.

Use the switching of the special-effects unit to accomplish the video changes desired.

For additional information, refer to the operation instructions of the special-effects unit. The two tapes make be considered as two camera input.

Note:

- The programmed editing cannot be made in this editing mode. Perform only one edit.

SELECTION OF EDIT POINTS WITH TAPE IN MOTION

It may be desired to enter the edit points while the tape is running (playback or search mode) and while watching the TV monitor. Follow the process described below.

Note that the tape in the Editor must be manually positioned at the proper location for the program beginning or edit-start point.

When a blank tape is used in the editor:

- (1) Press the Program Button [PROGRAM]. Be sure that the Program Lamp illuminates.
 - (2) Set the edit number using the Numeric Keyboard.
 - (3) Select the assembly edit mode: Press the Assembly Button [ASSY].
 - (4) Select the playback unit (VTR1 or VTR 2).
 - (5) Press the Source Button [SOURCE].
 - (6) Playback or search the playback unit.
 - (7) Press the Entry Button [ENTRY] at the desired edit-start point.
 - (8) Press the Exit Button [EXIT] at the desired edit-end point.
 - (9) Press the Program Button [PROGRAM]. The Program Lamp will flash, and the edit number will be increased by one.
 - (10) Repeat the steps (7) to (9) in accordance with the desired edit sequence.
- Selection of playback unit [VTR 1 or VTR 2] may be done at the beginning of each edit sequence. Select the desired playback unit by pressing the appropriate button after stopping the unit presently selected.

When a tape upon which continuous black-bust and time-code signals have been recorded is used.

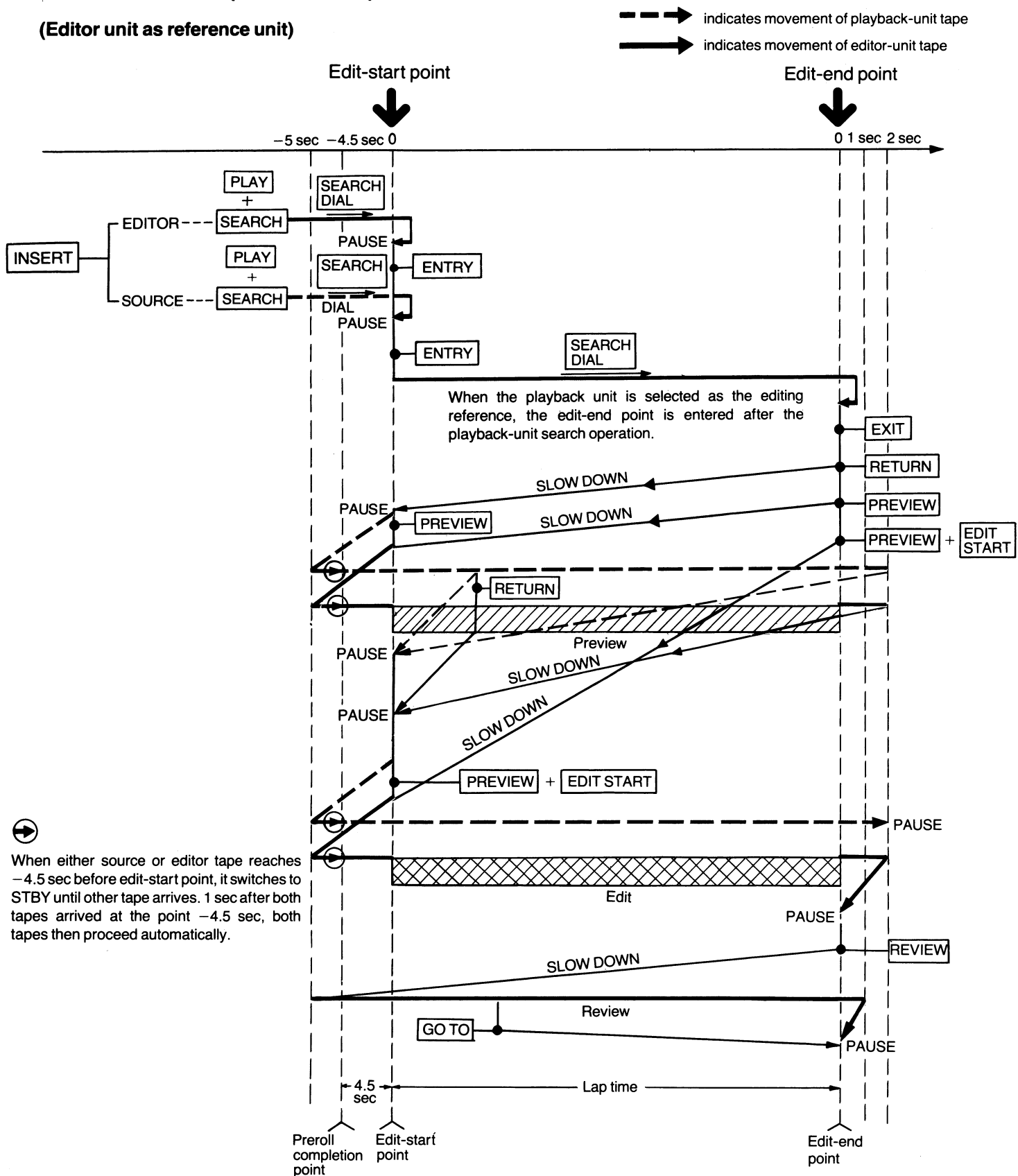
- (1) Press the Program Button [PROGRAM]. Check that the Program Lamp illuminates.
- (2) Set the edit number by using the Numeric Keyboard.
- (3) Select the insert edit mode: Press the Insert Button.
- (4) Select the edit reference: Press the Source Button [SOURCE].
- (5) Select the playback unit [VTR 1 or VTR 2].
- (6) Press the Source Button [SOURCE].
- (7) Play back or search the playback unit.
- (8) Press the Entry Button [ENTRY] at the desired edit-start point.
- (9) Press the Exit Button [EXIT] at the desired edit-end point.
- (10) Press the Program Button [PROGRAM]. The Program Lamp will flash, and the edit number will be increased by one.
- (11) Repeat the steps (7) to (10) in accordance with the desired edit sequence.

When the above operation has been completed, follow the steps described on pages 190 through 201.

INSERT-EDITING PROCEDURE

INSERT-EDITING (VTR TO VTR) TAPE MOTION

(Editor unit as reference unit)



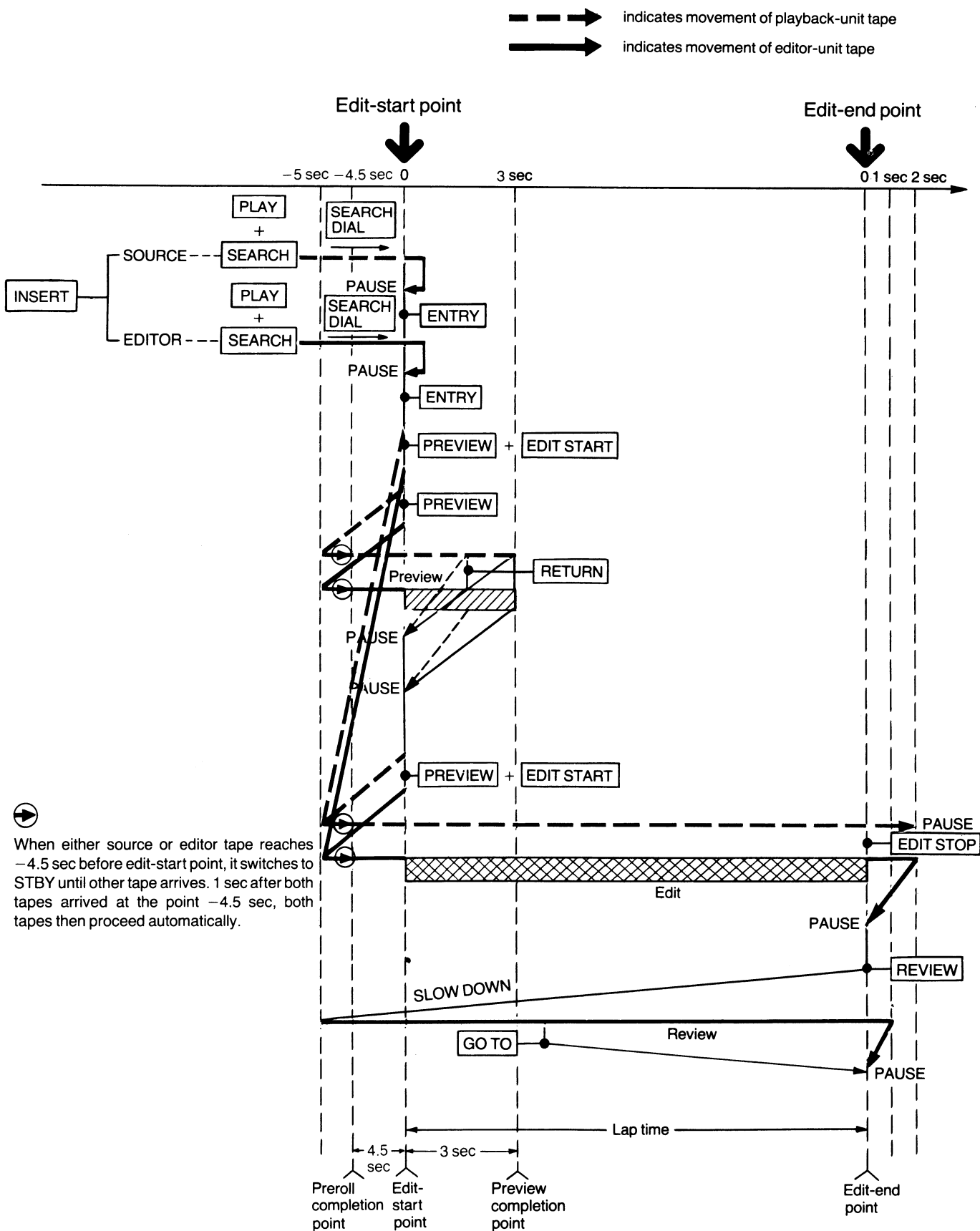
● Insert editing is principally done with the editor unit as the reference unit. If it is desired to use the playback unit as the reference unit, however, press the Source Button [SOURCE].

● Programmed Editing

When the Preview and Edit-Start Buttons are pressed simultaneously, the edit will automatically be performed by pre-programmed numbers.

INSERT-EDITING (VTR TO VTR) TAPE MOTION

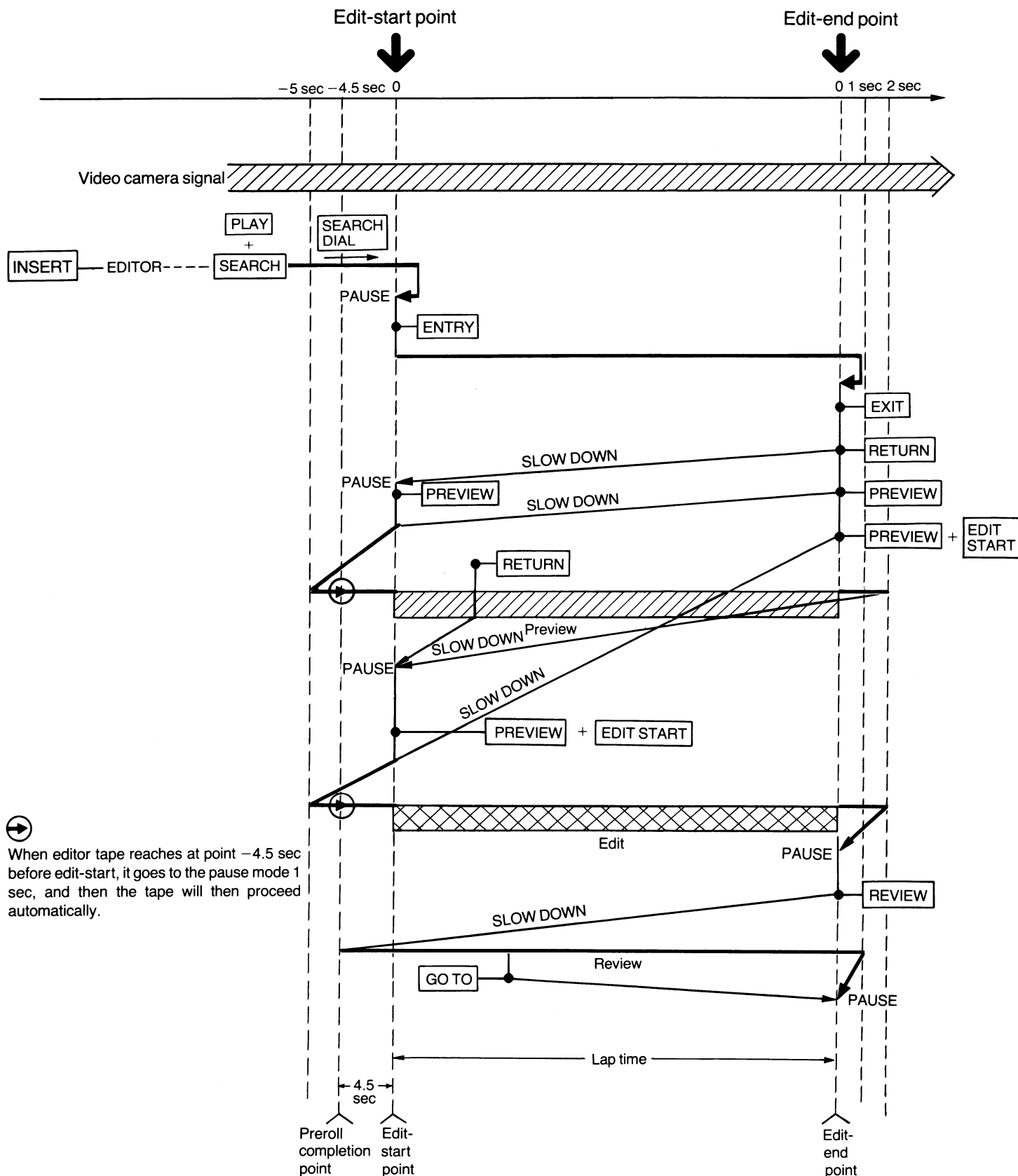
Insert editing without entry of an edit-end point



INSERT-EDITING (VIDEO) TAPE MOTION

(Editor unit as reference unit)

→ indicates the movement of the editor-unit tape.



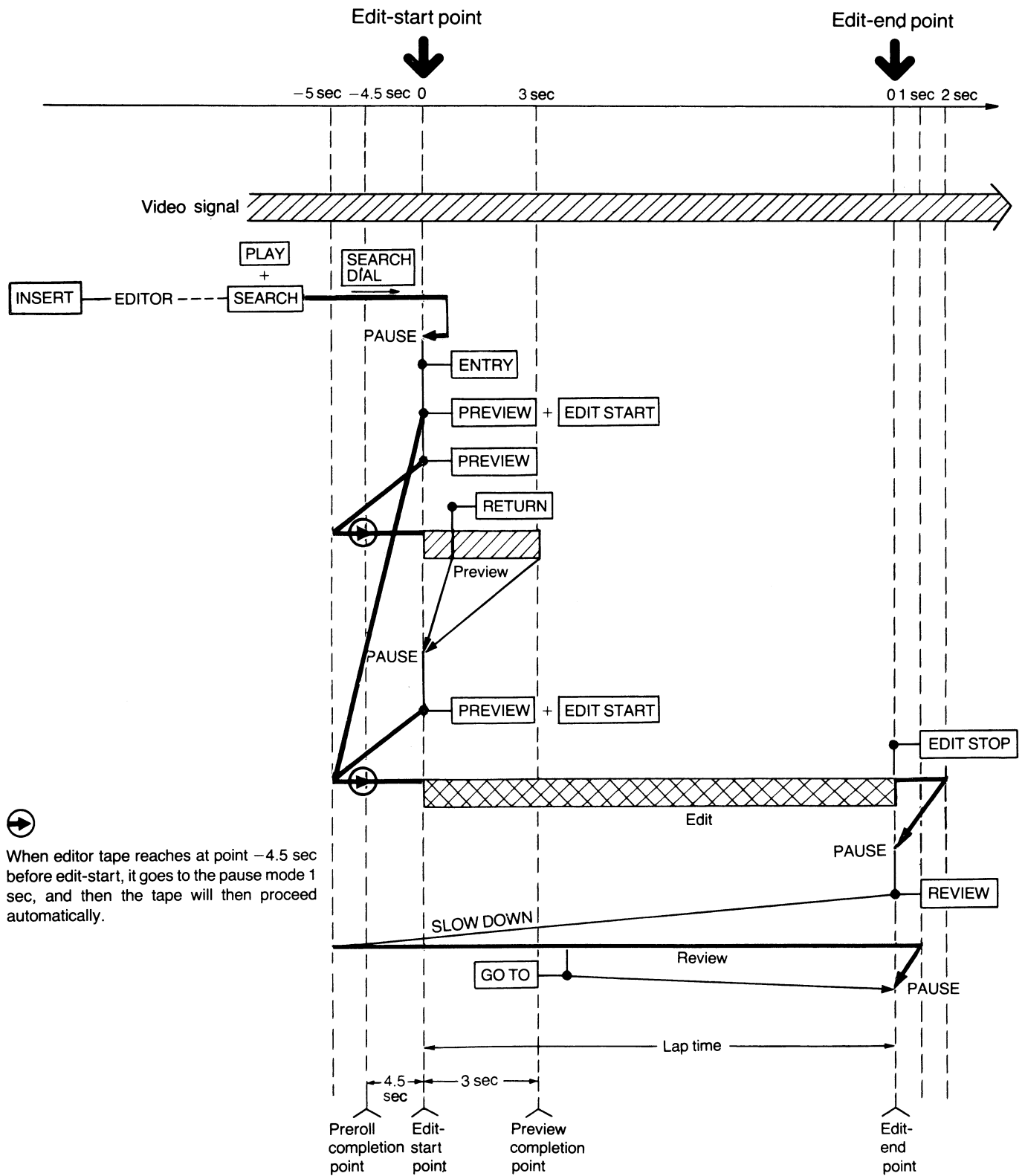
●Programmed Editing

When the Preview and Edit-Start Buttons are pressed simultaneously, the edit will automatically be performed by pre-programmed numbers.

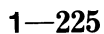
INSERT-EDITING (VIDEO) TAPE MOTION

Insert editing without entry of an edit-end point

→ indicates the movement of the editor-unit tape.



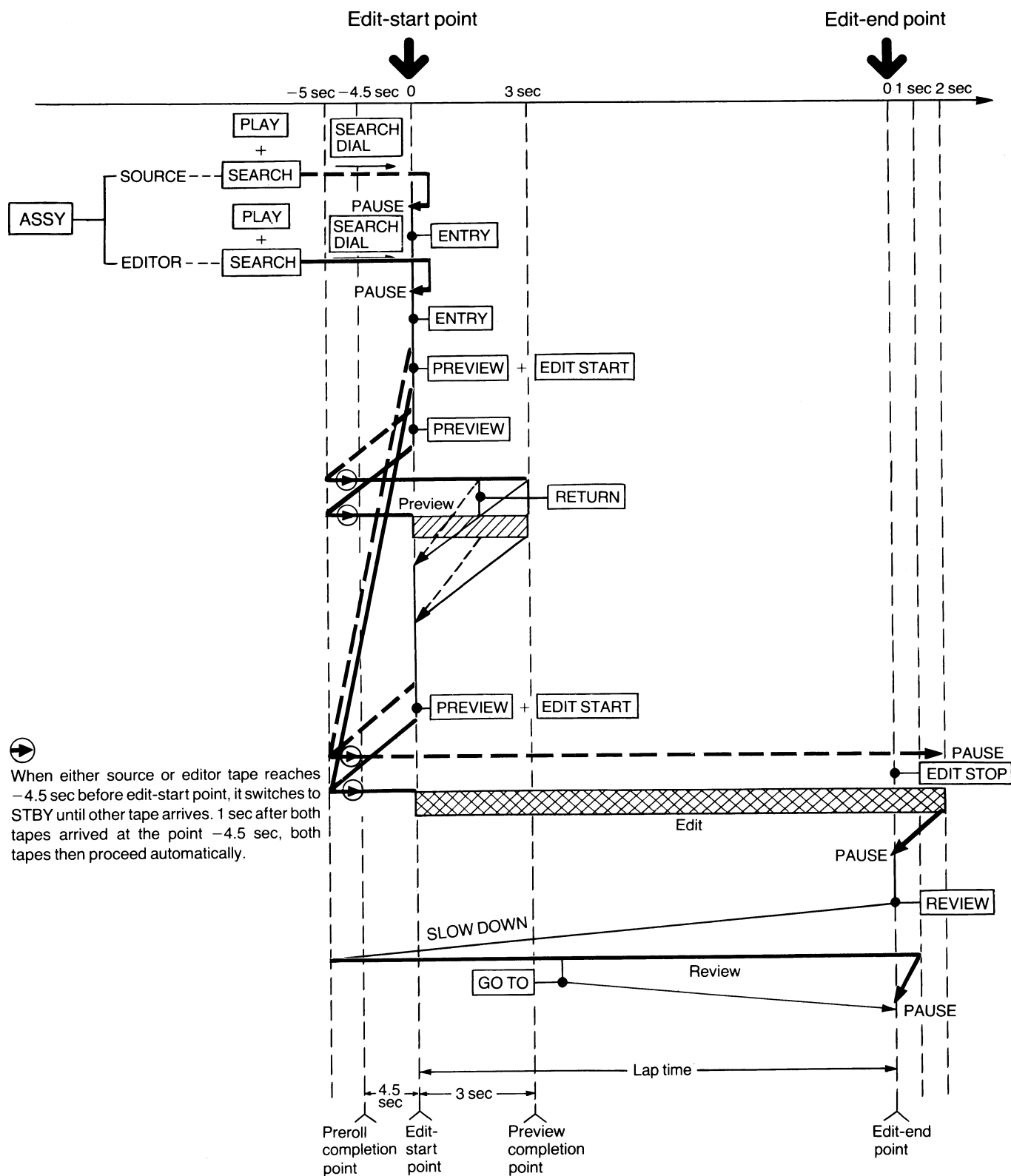
Assemble-editing with an edit-end point



ASSEMBLE-EDITING (VTR TO VTR) TAPE MOTION

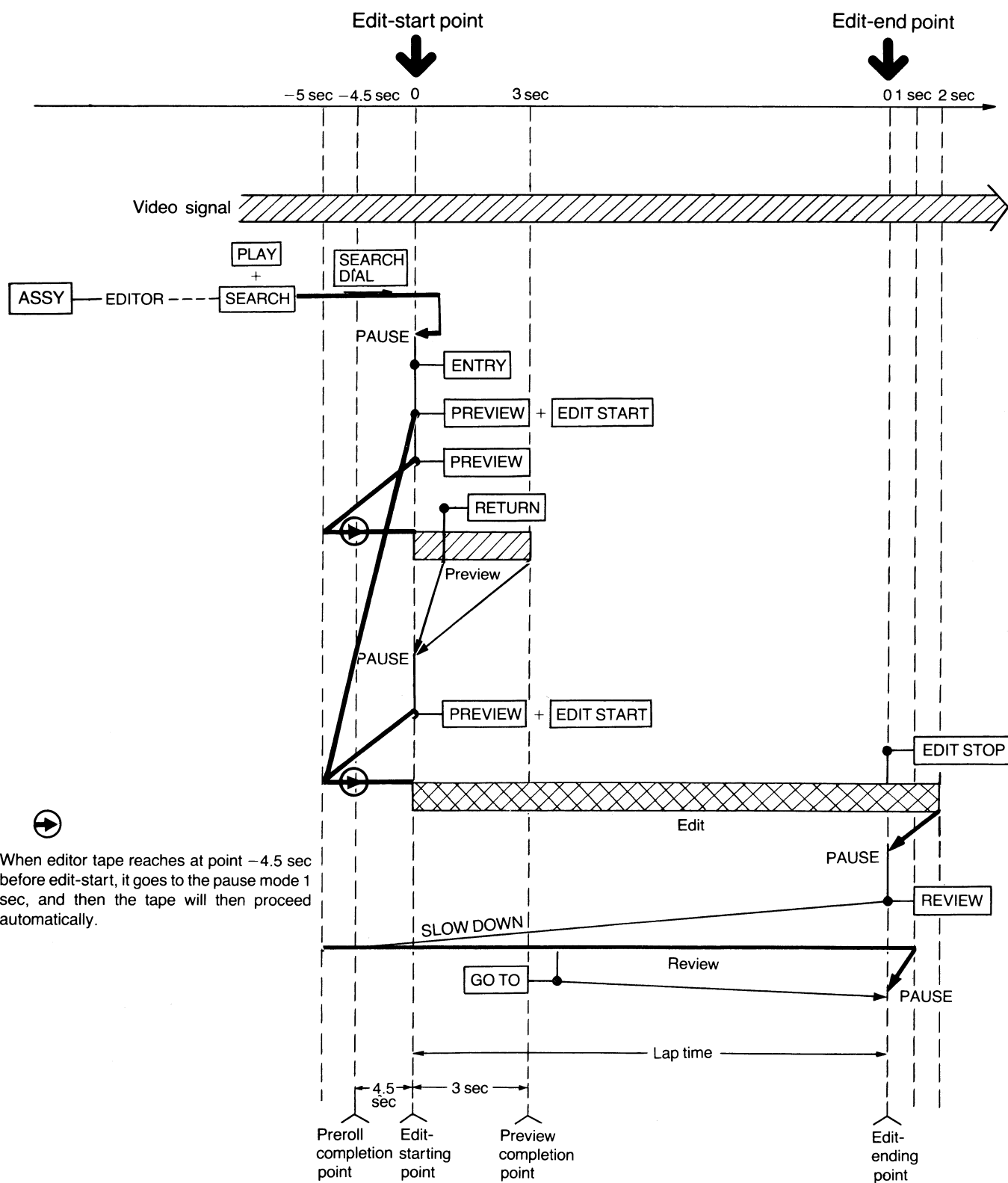
Assemble-editing without an edit-end point

- - - - - indicates movement of playback-unit tape
 ————— indicates movement of editor-unit tape



ASSEMBLE-EDITING VIDEO TAPE MOTION

→ indicates the movement of the editor-unit tape



When editor tape reaches at point -4.5 sec before edit-start, it goes to the pause mode 1 sec, and then the tape will then proceed automatically.

ERROR INDICATOR

If a mistake is made during the editing programming operation, it will be indicated by the letters “EE” in the Playback Counter Display. If one of the following error indications appears during operation, correct the editing procedure, or repeat the setting programming.

Check	Error indication	Error location
●When the Entry Button [ENTRY] or the Exit Button [EXIT] has been pressed.		An editing mode has not been selected. Select the editing mode, and then follow with the correct editing procedure.
		No selection of the source playback unit.
		Over 20 programmed edits have been entered.
		No selection of editor or source has been made in the keyboard.
		This shows that there is something extraordinary in the data entered in time indication. For example, the time exceeds that possible.
		The line (video) source has been selected. Dual playback start is impossible.
●When the Go To Button [GO TO] has been pressed.		The edit-end point has not been entered for this edit.
		No selection of source or editor has been made in order to search for a specific time-code address.
		The line (video) source has been selected. Search is impossible.
●When the Return Button [RETURN] has been pressed.		The edit-start point has not been entered on the tape. Enter the edit-start point onto the tape.
●When the Review Button [REVIEW] has been pressed.		The review operation cannot be performed because the edit has not been made.
●When the Preview Button [PREVIEW] and the Edit-Start Button [EDIT START] have been pressed simultaneously.		The edit-start and -end points have not been selected. Select the editing mode, and then follow with the correct editing procedure.
		The edit-start point has not been entered. Enter the edit-start point.
		Insert-editing is being attempted without first entering the edit-start point. Enter the edit-start point.

Check	Error indication	Error location
●When the Preview Button [PREVIEW] and the Edit-Start Button [EDIT START] have been pressed simultaneously.		The editing modes of the edit-start and -end points are different. Select the same editing mode, and then follow with the correct editing procedure.
		The editing references of the edit-start and -end points are different. Select the same editing reference, and then follow with the correct editing procedure.
		The entered address indication of the edit-start point is a larger number than that of the entered address indication of the edit-end point. Check the time code, select the editing mode, and then perform the editing operation once again.
		Insert-editing is being attempted without connecting the editor unit. Press the Edit Stop Button and make sure that the connection is right, and thereafter follow with the current editing procedure.
		Editing cannot be done, but the Preview will function. Make sure of the following points. ●Is the red record button inserted into the large hole at the back side of the cassette tape as the editor unit)? ●The editing modes of the editor unit and the editing controller AU-A70 are different.

Editing Controller AU-A70

General Introduction

The AU-A70 Edit Controller utilizes three video tape recorders (VTR) to perform the controlled transfer of vicoe and audio from a tape in two Source to the other (Editor). These units may be the NV8170/8200 (VHS), the NV9200A/9500A (¾ inch U format) or the NV9240/9600 (New ¾ inch SMPTE E format). The Edit Controller is designed to maximize the features of the AU-700, and the other system configurations provide lesser degrees of flexibilites.

The edit controller does not perform the edit, it sends a precisely controlled command to the Editor VTR, which in turn actually performs the edit.

However, for ease of description, it is easy to think of the controller as “performing” an edit, so this concept is used.

Video and audio information are taken from one VTR (the Source, since the material comes from it), and is simply cabled to the inputs of the recording VTR, called the Editor.

There are two modes of editing—Insert and Assembly. (These are described in the Operation Instructions in the front of this manual.) Briefly, Assemble is pieces of program put together in succession, like links in a chain, with the previous part always recorded before the current one. In this case, video and audio signals must match perfectly at the start of the current segment, which is the end of the last segment. At the end of the current segment, the recorder is allowed to run for a short time beyond the desired end point so that the process may be repeated.

MODEL MODE		NEW 3/4"		3/4" PREVIOUS		CURRENT VHS		REMARKS	
		NV-9240, NV-9600 AU-700		NV-9200A, NV-9500A		NV-8170, NV-8200			
		FUNCTION	DETECTION OF CONTROL SIGNAL	FUNCTION	DETECTION OF CONTROL SIGNAL	FUNCTION	DETECTION OF CONTROL SIGNAL		
FORWARD OPERATION	FF	○	○	○ (no Picture)	×	○ (no Picture)	○	○ = Yes	
	PLAY × 1	○	○	○	○	○	○	×	No
	× 1/20	○	○	×	—	×	—		
	× 1/5	○	○	○	○	○ (Slow mode 1/5 — 1.5)	○		
	× 2	○	○	○	○	○	○		
	× 5	○	○	×	—	×	—		
REVERSE OPERATION	REW	○	○	○ (no Picture)	×	○ (no Picture)	○		
	× 1/20	○	○	×	—	×	—		
	× 1/5	○	○	○ (Slow Rewind Mode Approx. 1/5)	○	×	—		
	× 1	○	○	×	—	×	—		
	× 2	○	○	×	—	×	—		
	× 5	○	○	×	—	×	—		

Figure 3-1

All of these functions, plus the others described in detail in the instructions, are performed in response to buttons controlled by the operator. However, much of the process is precise and automatic, and must be an internal part of the Edit Controller. All the automatic and internal functions are done by a microprocessor based control system.

To do all this, the microprocessor system has inputs (from the VTR, operator buttons, etc.) and outputs (lights, VTR commands, etc.). Further, it has two memories which hold two kinds of information. There is a short term memory which holds the tape times, the edit mode, the choice of signals and the like.

The CPU group is comprised of the microprocessor (8080A), the clock generator (8224) and the system controller (8228) which are interconnected to form a single functional unit as shown in Fig. 3-3.

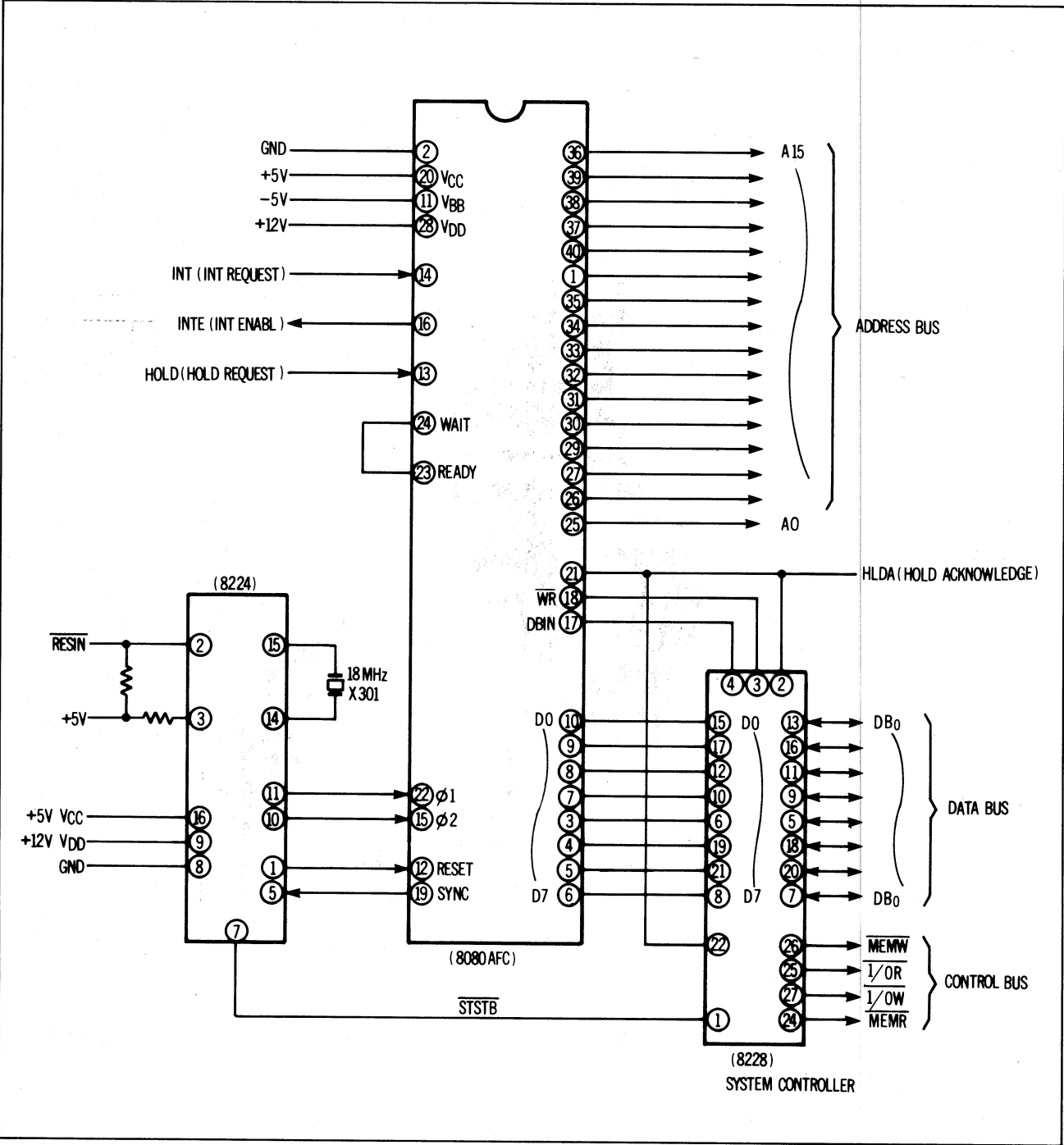


Figure 3-3

Clock Generator 8224.

The clock generator (8224) has the primary function of crystal oscillator and divider (18 MHz and $\div 9$) to form a two phase non-overlapped clock drive for the microprocessor (MPU), along with a separately buffered TTL compatible ϕ_2 output. All processor operation is based upon these clock signals. In addition, the 8224 provides for system power-up reset, ready synchronization, and the status strobe for the system controller, which is formed from the MPU sync output (See Fig. 3-4).

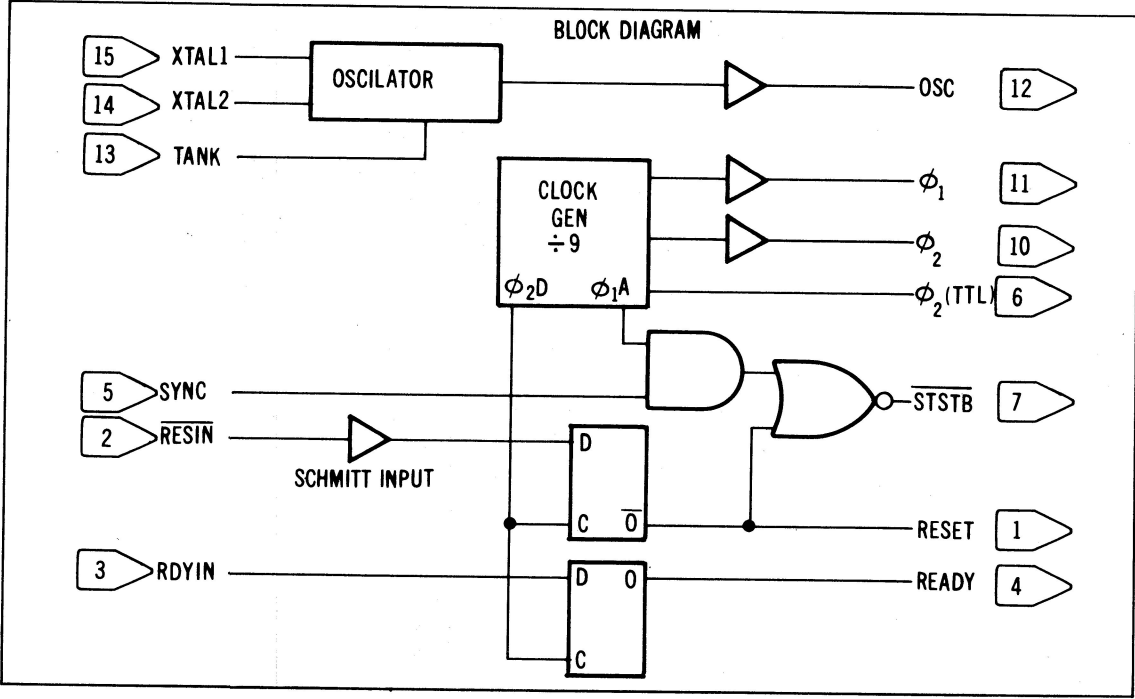


Figure 3-4

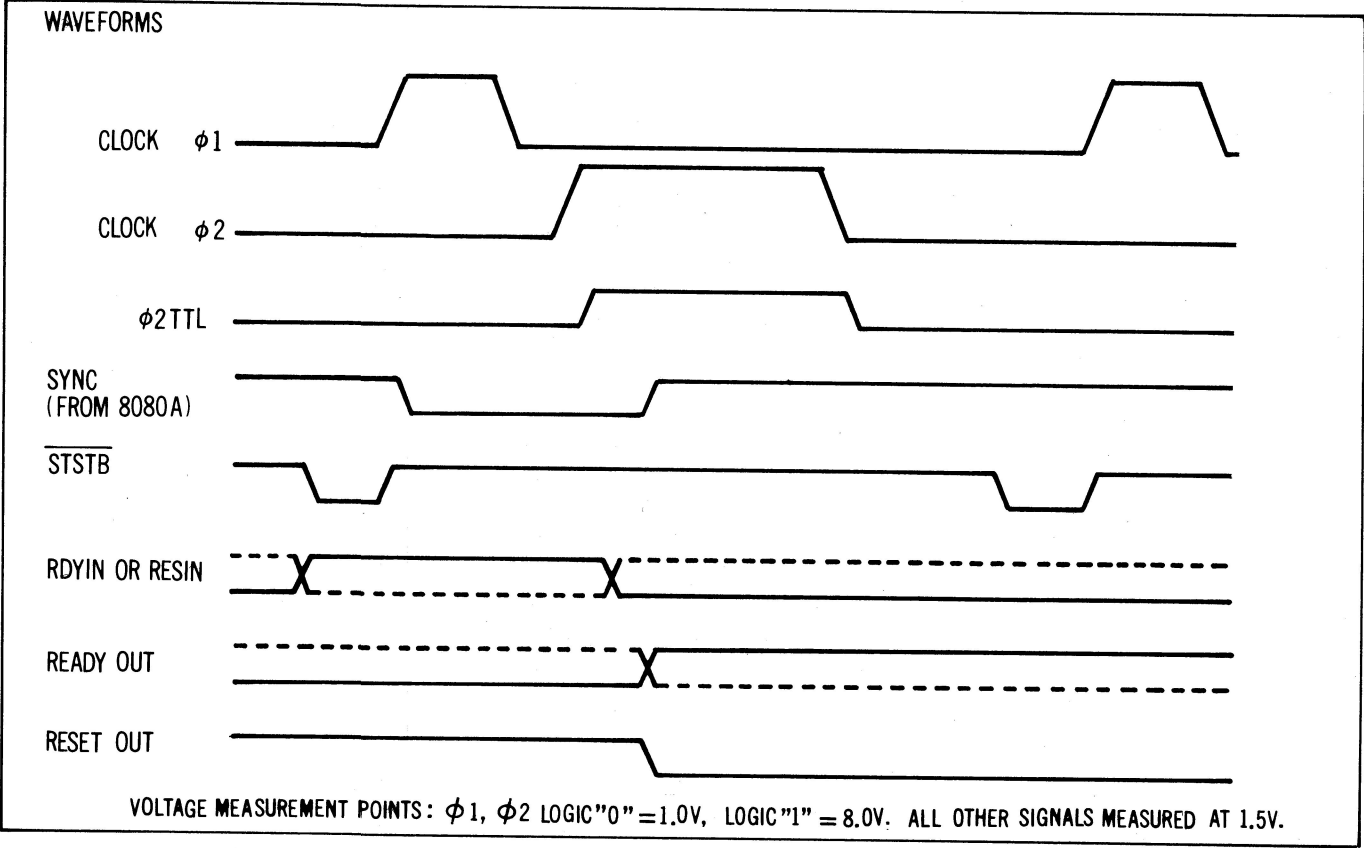


Figure 3-5

Microprocessor 8080A

The microprocessor (MPU), an 8080A, is an 8 bit parallel microprocessing unit. The 8080A has a 16 bit address bus which allows a maximum 64K bytes of memory and an 8 bit bidirectional data bus. Both may be placed in a tristate (high impedance or floating) mode by the Hold function for easy implementation of Direct Memory Access (DMA). Up to 256 Input and Output (each) ports may be used, and all MPU terminals (except clock) are TTL compatible.

The instruction set consists of 78 operations, including DAA, the decimal conversion of the accumulator contents, and 16 bit (double precision) arithmetic.

The basic architecture consists of six 8 bit scratch pad registers (grouped as pairs), an 8 bit arithmetic logic unit (ALU), a 16 bit program counter (for program address generation) and a 16 bit stack pointer for support of multiple (nested) interrupt software. The ALU has six flag flip-flops: Zero, Carry, Sign, Parity, Carry/2, and Sub; and an 8 bit accumulator. The instruction register is 8 bit. An 8 bit program status word (PSW) is available at the data bus when the status strobe is present.

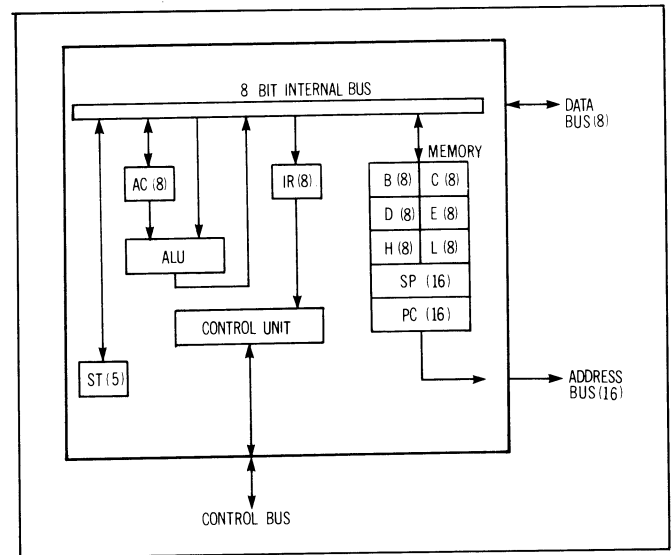


Figure 3-6

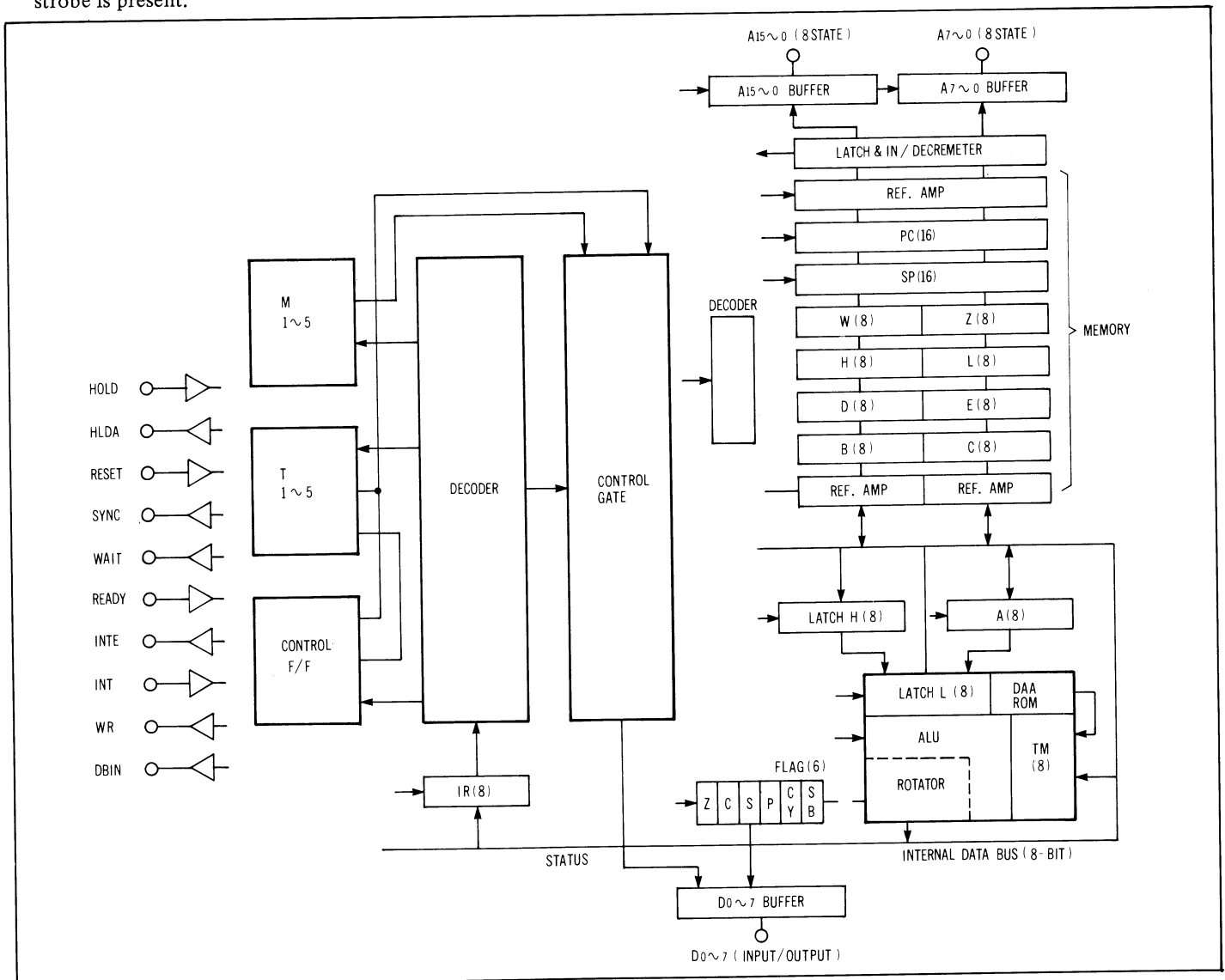


Figure 3-7

1. Instruction Register (IR)

Instructions fetched from memory and stored in the Instruction Register are decoded to control the other parts.

2. Memory

- (1) Working Registers of the CPU consist of the accumulator (A), 6 scratch pad registers (B.C.D.E.H.L), and 2 temporary registers (W.Z).

- (2) Program Counter (PC)

The 16 bit program counter (PC) holds the memory address of next instruction.

- (3) Stack Pointer (SP)

The 16 bit stack pointer (SP) holds the memory address which indicates the beginning of the stack, and when data is pushed to the stack it decrements by 2 (-2).

The Arithmetic Logic Unit (ALU) performs logic, arithmetic and rotation. The 8 bit accumulator (AC) and 5 bit status register (ST) can be directly accessed.

The CPU has 6 flag bits (Zero, Carry, Sign, Parity, C/2, SUB) set by the ALU.

The Address 16 bit address latch/bus means that the address bus (memory address) can be up to 64K bytes; the least significant 8 bit address bus (A7 ~ A0) and most significant 8 bit address bus (15 ~ A8) are used to output the I/O device number (256 of each, maximum).

When CPU is in Hold (HLDA="1"), the address bus floats.

The Data bus communicates bidirectionally between CPU and any other device. The Input mode of the Data bus is set by DBIN signal and output mode of the Data bus is set by WR signal.

Symbol	Clock	Content
SYNC (Output) Synchronizing	$\phi 2$	The SYNC signal indicates the beginning of each machine cycle, and status information (latched by $\phi 1$) is on the data output.
DBIN (Output) Data bus IN	$\phi 2$	The DBIN signal indicates that the data bus is in the input mode.
WR (Output) Write	$\phi 1$	The WR signals used for memory WRITE or I/O output, indicates output data present.
READY (Input)	$\phi 2$	The READY signal indicates to the CPU that valid data is on the data bus.
WAIT (Output)	$\phi 1$	The WAIT signal acknowledges that the CPU is in a wait state.
HOLD (Input)	$\phi 2$	The HOLD signal requests the CPU to enter HOLD. When in HOLD, CPU outputs the HLDA signal and floats the data bus and address bus.
HLDA (Output)	$\phi 1$	The hold acknowledge (HLDA) signal appears in response to the HOLD signal.
INT (Input) Interrupt Request	$\phi 2$	The Interrupt (INT) signal can interrupt the CPU, unless in HOLD or INTE F/F is reset. The system controller generates the Interrupt acknowledge INTA output.
INTE (Output) Interrupt Enable	$\phi 2$	The Interrupt Enable (INTE) indicates if an interrupt is possible or not, based on the INTE F/F (set by E1 command and reset by D1).
RESET (Input)	$\phi 1$	The RESET SIGNAL CLEARS THE PC, the address bus and the data bus float. The flags, accumulator, stack pointer, and registers are not cleared.

Figure 3-8

System Controller 8228.

The System Controller (8228) is a companion device for use with the 8080A MPU. It isolates the MPU data I/O from the main data bus, and receives the program status word (PSW) and the control outputs from the MPU to generate the control bus outputs.

There are ten program status words, as shown in Fig. 3-9.

The program status words appear only during the system status stroke (STSTB), and are not brought to the user side of the data bus. They are used by the System Controller to determine the correct control bus signals.

The block diagram (Fig. 3-10) shows the inputs and outputs of the system controller.

The control bus utilizes the following signals:

MEM R Memory read output (Control memory direction)

MEM W Memory write output

I/O R I/O read output

I/O W I/O write output

(Control Input Output direction)

BUSEN Bus Enable Input

(Cause Data Bus to Float)

INTA Interrupt Acknowledge

(Output Interrupt in progress)

Together these three blocks work to perform the instructions which the memory holds, based on the inputs which come in via the input ports, in order to generate the proper outputs at the output ports.

		TYPE OF MACHINE CYCLE									
		STATUS INFORMATION	INSTRUCTION FETCH	MEMORY READ	MEMORY WRITE	STACK READ	STACK WRITE	INPUT READ	OUTPUT WRITE	INTERRUPT ACKNOWLEDGE	HALT ACKNOWLEDGE WHILE HALT
DATA BUS BIT		①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
D0	INTA	0	0	0	0	0	0	0	1	0	1
D1	W0	1	1	0	1	0	1	0	1	1	1
D2	STACK	0	0	0	1	1	0	0	0	0	0
D3	HLTA	0	0	0	0	0	0	0	0	1	1
D4	OUT	0	0	0	0	0	0	1	0	0	0
D5	M1	1	0	0	0	0	0	0	1	0	1
D6	INP	0	0	0	0	0	1	0	0	0	0
D7	MEMR	1	1	0	1	0	0	0	0	1	0

Figure 3-9

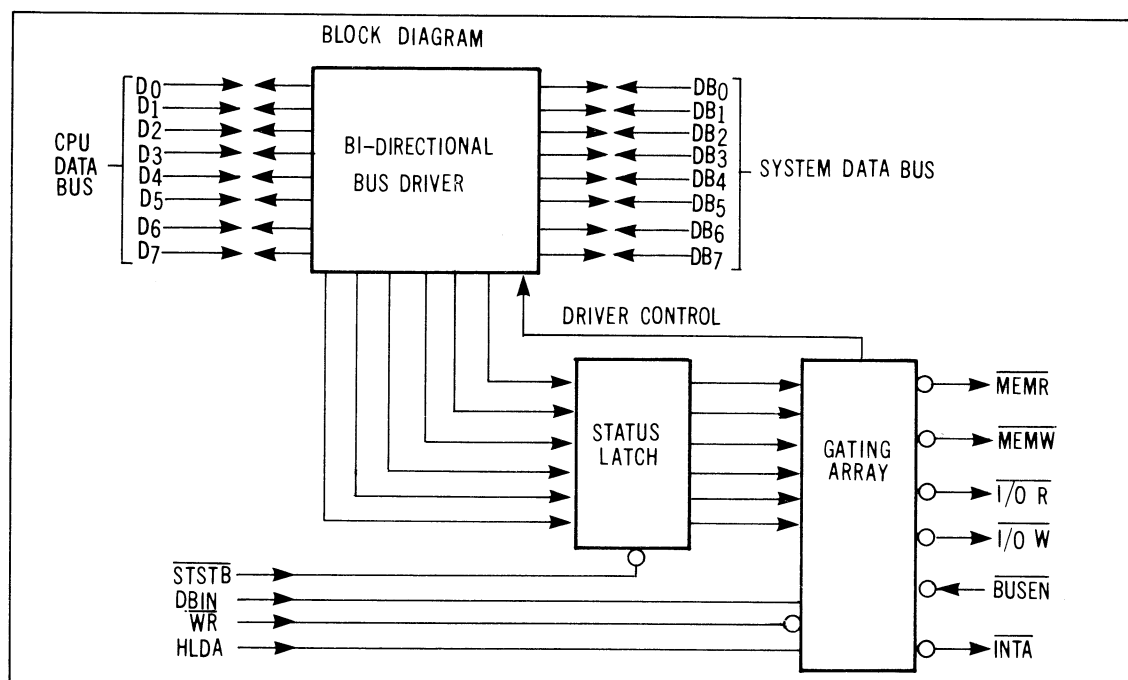


Figure 3-10 1-235

The hexadecimal system

The data and address buses are shown as eight or sixteen bit groups of signals. It is important to note that these are actually multiple four bit groups. The four bits represent numbers in a binary counting sequence (powers of two, rather than powers of ten). In a base ten number system with place value, which is the way people count, 195 means one 100 and nine 10's and five 1's ($1 \times 10^2 + 9 \times 10^1 + 5 \times 10^0$). If a place value system is used for binary (base 2) counting, it follows the same system: the lowest number is 2^0 , next is 2^1 , then 2^2 , and 2^3 and so on. Therefore, if there is a four bit signal (four wires), it can be any number from 0 to 15 (decimal).

As can be seen in Table A the use of a hexadecimal system maximizes the four bits, using all the combinations from all low (0000) to all high (1111), or 0 to F in hex.

The data bus can be thought of two hex numbers presented in parallel. In the case shown in Table B, the number on the data bus would be said to be "2A", equal to 42 decimal.

Notice that even though the numerical value may be expressed in two hex symbols, since the maximum count possible in four bits is used, the value of the next place follows in sequence.

This same system is used for the address bus, which is grouped into four hex numbers, as shown in Table C.

DECIMAL BASE 10	BINARY BASE 2	HEXA- DECIMAL	BINARY CODED DECIMAL (BCD)	OCTAL BASE 8
0	0	0	0000	0
1	1	1	0001	1
2	10	2	0010	2
3	11	3	0011	3
4	100	4	0100	4
5	101	5	0101	5
6	110	6	0110	6
7	111	7	0111	7
8	1000	8	1000	10
9	1001	9	1001	
10	1010	A		
11	1011	B		
12	1100	C		
13	1101	D		
14	1110	E		
15	1111	F		

TABLE A

	D7		DIGITAL	BINARY	HEX	DECIMAL
DATA BUS	MSD		0	2^7		
			0	2^6		
			1	2^5	2	32
			0	2^4		
	LSD		1	2^3		
			0	2^2		
			1	2^1	A	10
			0	2^0		
	D0					

TABLE B

BIT	BASE 2	DIGITAL	DIGITAL	DECIMAL VALUE	TOTAL COMBINATIONS
A15	2^{15}	0	1		61,440
A14		0	1		
A13		0	1		
A12		0	1		
MSD		0	1		3,840
		0	1		
		0	1		
		0	1		
ANY VALUE		0	1		240
		0	1		
		0	1		
		0	1		
A3		0	1		15
LSD		0	1		
		0	1		
		0	1		
A0	2^0	0	1		

TABLE C

B. Memory

In order to perform any operation, the MPU must receive an instruction which will instruct it how to proceed. These instructions, stored one after another in the precise order needed, is called the Program. These program instructions are held or stored in 8 bit “words” in a memory. The memory remembers each word and stores it by line, or address.

Calling up any line will produce the word stored there at the memory data output. When this word is sent to the MPU it knows how to proceed.

The address of the instruction comes from the program counter. Since all the instructions are in the order in which they will be used, the program counter simply counts up by one each time an instruction is used, so the next instruction is available. At Power On, the program counter starts at “00”.

The Program memory in this system is a 2K (2048 word x 8 bit) ultraviolet erasable electrically programmable read only memory (UV-EPROM). This means that data stored in the memory (by the system programmer) will be held indefinitely, regardless of power on or off, unless the memory chip is exposed to high level ultraviolet radiation. The light will scrub the memory clean (empty), and it may be reprogrammed by a special system, as it was in the first place.

In a finished product such as this Edit Controller, the program in the ROM is never changed, and an opaque sticker is placed over the window in the IC. To program the memory, the program pin is connected to a voltage much higher than normal. The diagram shows the organization of the memory within the IC. (Fig. 3-12)

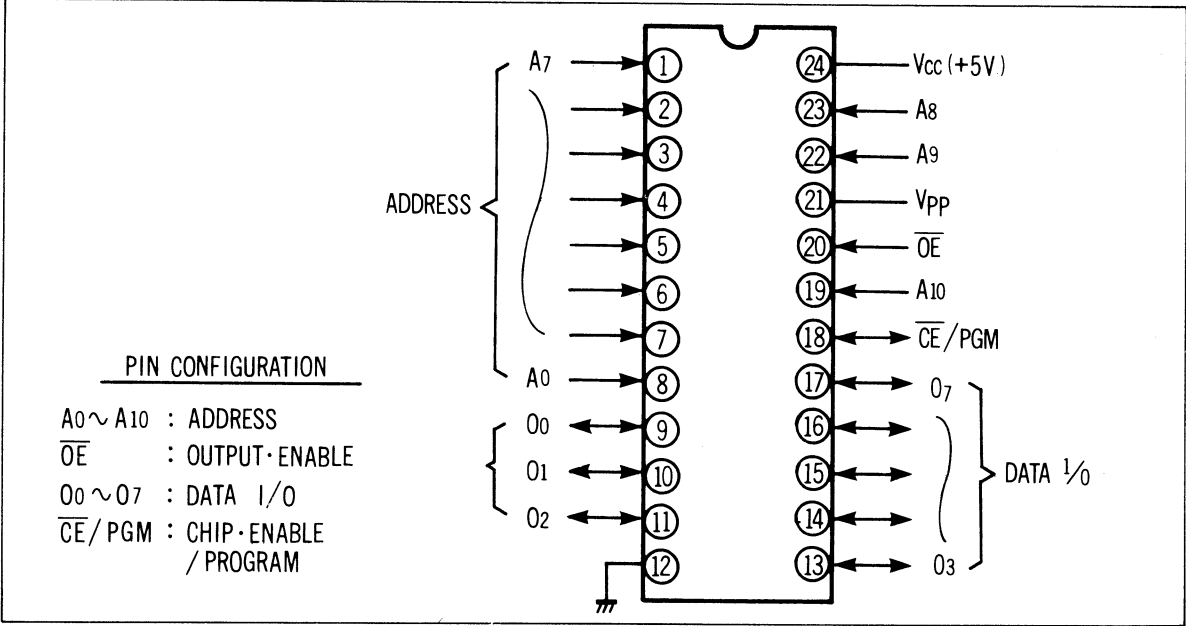


Figure 3-11

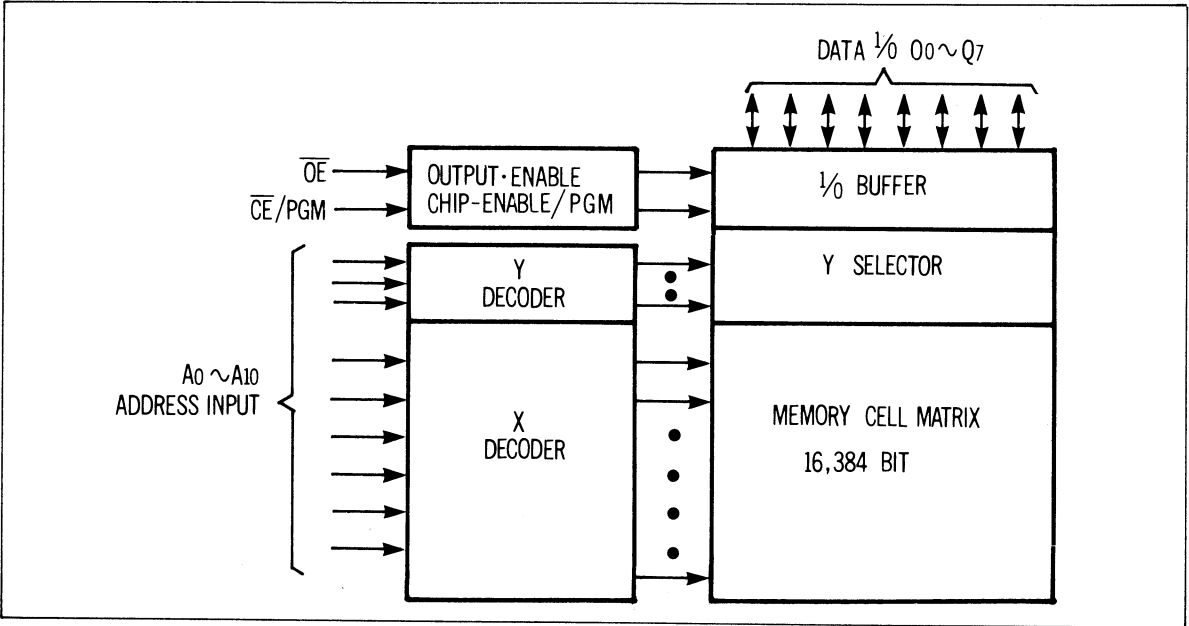


Figure 3-12

Random Access Memory

The name for this memory, random access (RAM) might better be Read and Write Memory, to contrast it with the Read Only Memory (ROM) which holds the program. This RAM memory can take data from the data bus and store it in the specific line identified by the address input (write mode) and return later to output the same data when that address location is again presented to the address input (read mode). However, if the power is lost, all the data is lost (volatile).

While the system is in use and power applied, the processor (MPU) is programmed to store certain information (data) from the outside world, such as the edit-in point or the edit-out point, as well as same internal information, such as the stack, in specific locations in this memory.

The stack is a part of this temporary memory that is defined by the programmer to be used for internal information. (The MPU, if interrupted, needs a place to hold the data it was operating upon while it responds to the interrupt. The stack pointer keeps track of the location of this information.)

The user supplied data (edit times, machine function, and the like) are always stored in locations defined by the program. For example, the first digit of edit-in time is always placed in the same line of RAM memory.

This means the program always knows where to find information, since each piece has a predetermined spot, or location. The diagram in Figure 3-14 shows the organization of the RAM memory.

This memory has 4 data inputs and 4 data outputs, which means it is a 4 bit memory (each word is half the length of the ROM word, or the MPU word) so two memory chips operate in tandem, with one for the 4 least significant bits (LSB) or lower numbers, and one for the 4 most significant bits (MSB). In this system, the 4 inputs and 4 outputs will be connected, since the data bus is bidirectional. (This is not always the case.) The read/write (R/W) pin dictates the internal mode. Each chip has provision for 256 words of 4 bits, so two in tandem still hold 256 words, but 8 bits long. These 4 bit groups are occasionally called the upper and lower nibble of the 8 bit word or "byte".

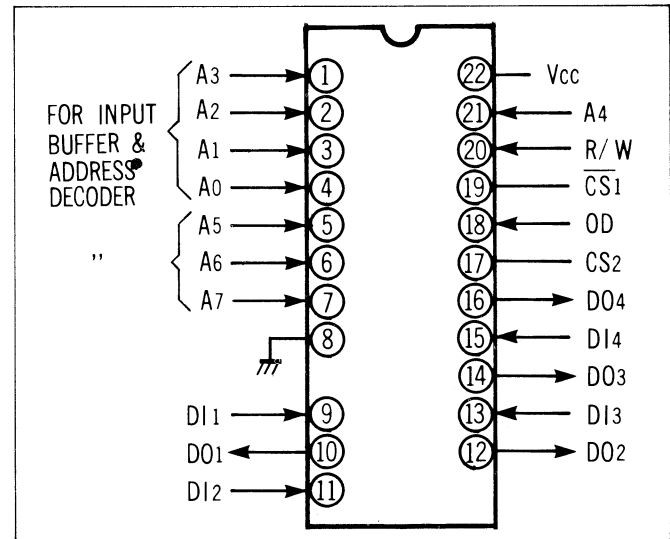


Figure 3-13

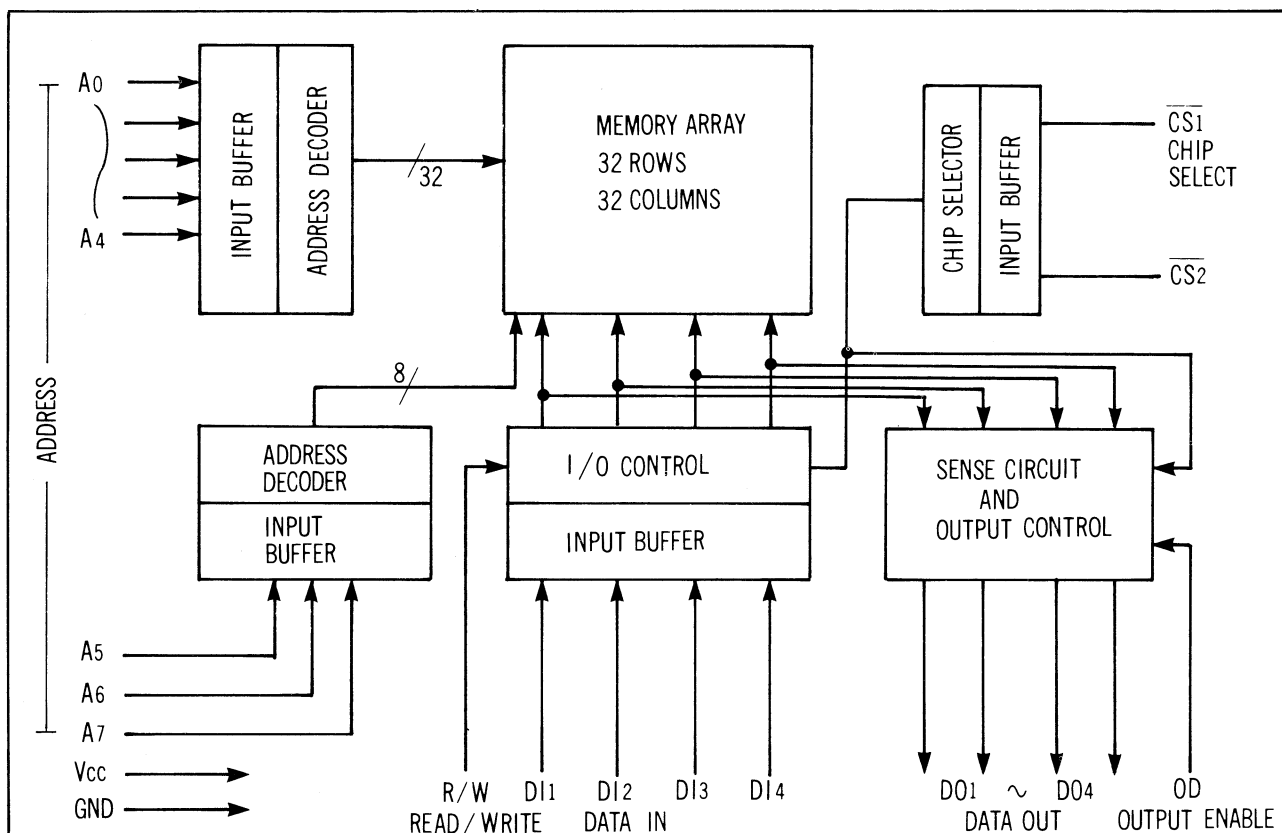


Figure 3-14

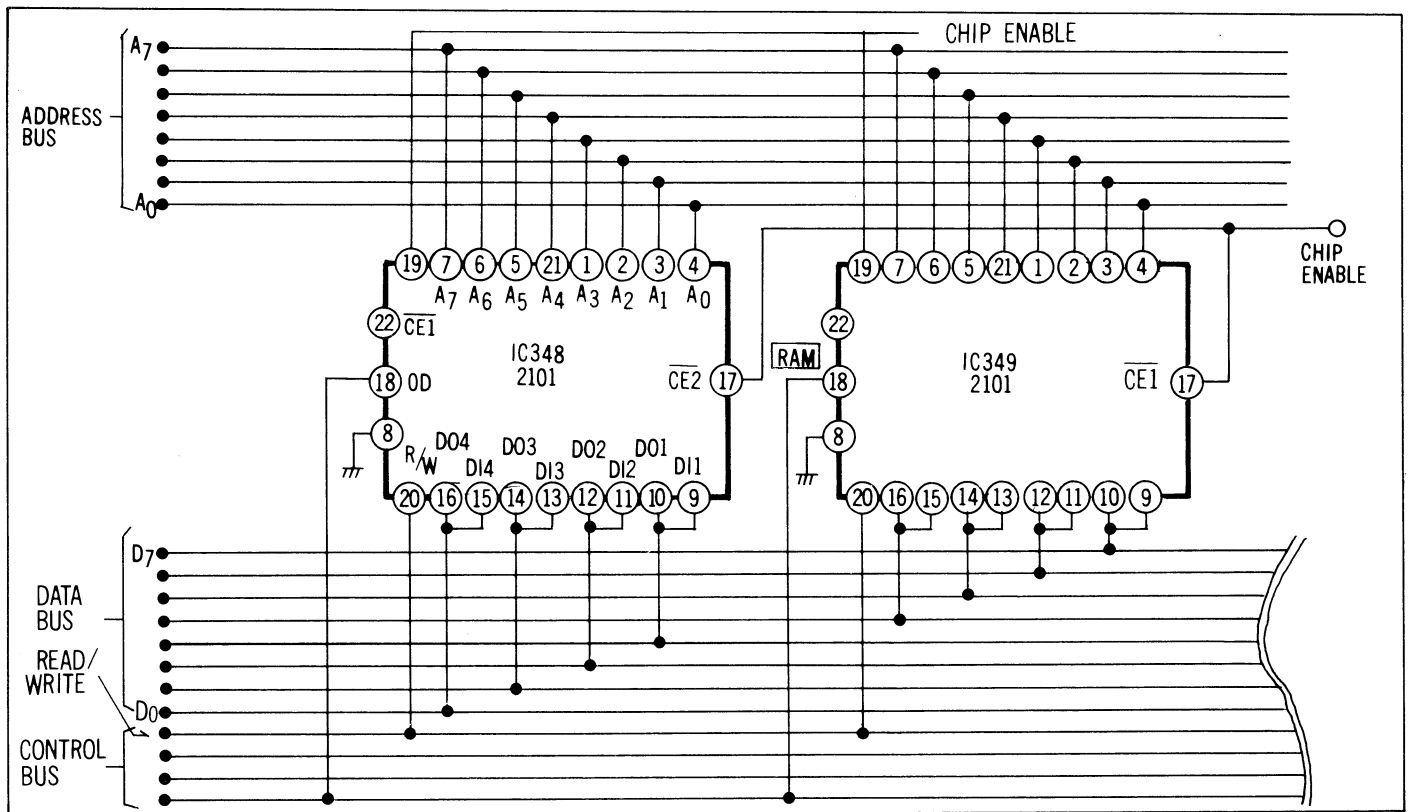


Figure 3-15

C. Address Bus Structure

More memory is required than just one circuit. However, the lower address bits, and the address inputs to which they connect, form the same numbers, so a separate decoder is used to drive the chip enable (CE) inputs to specify which chip should be active.

IC 350 functions as a 3 line to 8 decoder. (See the block diagram and the logic table, Fig. 3-16.)

This same technique is used for the RAM, although the RAM memory has only 8 address bits (only 256 locations).

Therefore, for the RAM, Address Bits 9 or 10 are decoded by IC353 in the same fashion as IC350. Since the two RAM memories are in tandem, the first output of IC350 enables both IC348 and 349, for the most and least significant bits, respectively.

This means that the field of ROM memory and that of RAM have the same address, bits A0 to A10. To decide which is desired, the MSB (A15) and MEMR (not memory read) are gated together, since in the write mode the ROM can not be used, and the MSB divides all the address numbers in half (above and below 32K).

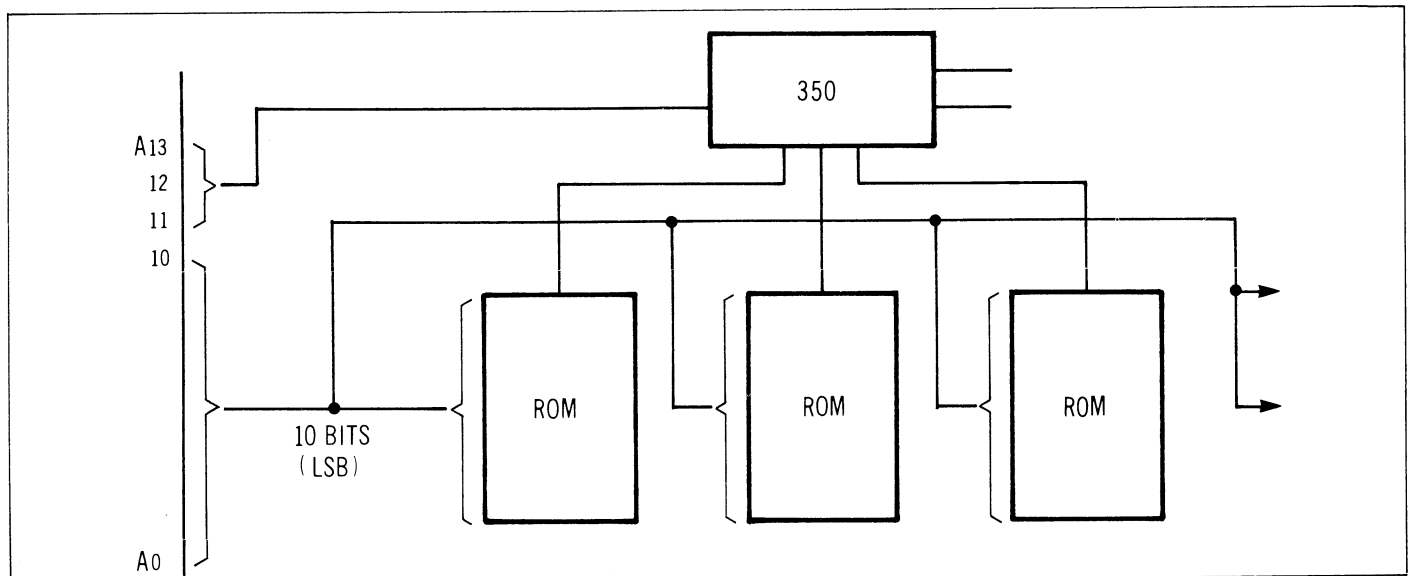


Figure 3-16

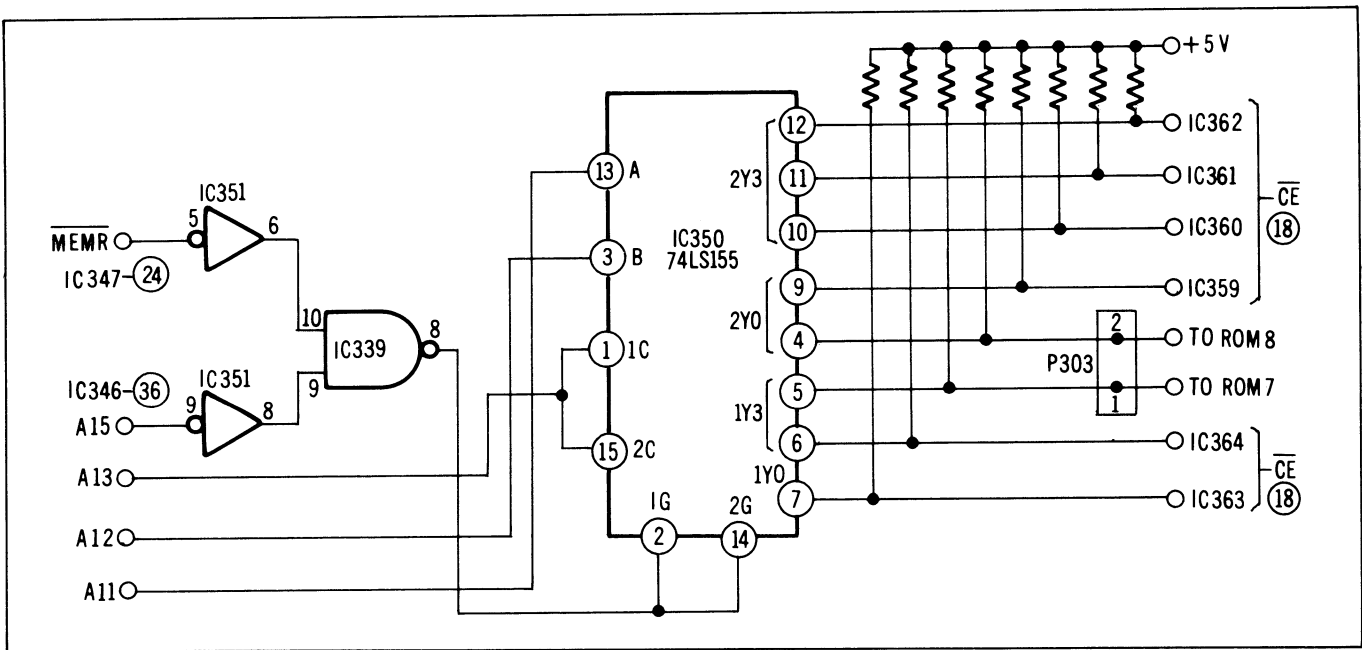


Figure 3-17

ADDRESS SIGNIFICANCE

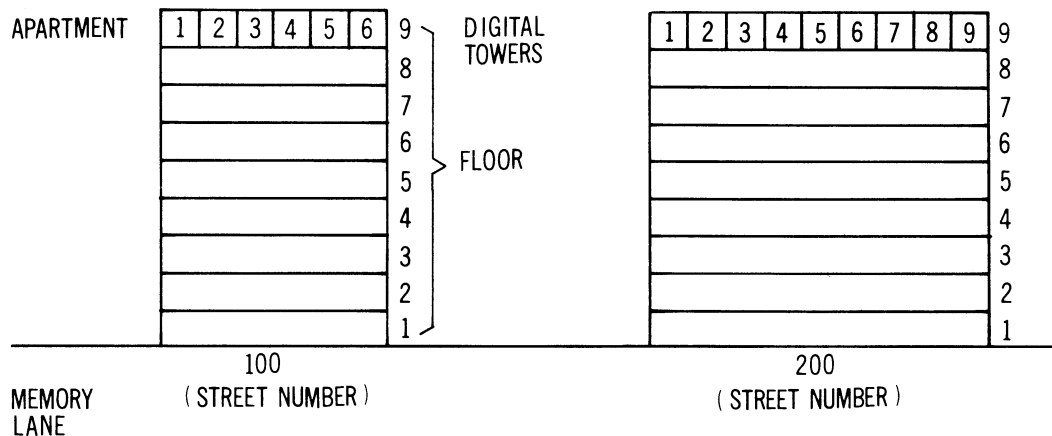
In order to realize the concept of multiple memory chip addressing, the following example may help.

If two identical apartment complexes exist one block apart on the same side of the street, and each complex has ten floors and ten apartments on each floor, the mailing address for any apartment could be defined by a three digit number.

To mail something to a specific apartment, all three numbers, have meaning. For example, 283 is the third apartment on the eighth floor of the second building. The 2 is called the most significant digit (MSD) because if it's wrong, we would have the wrong building (it makes the biggest change).

The 3 is the least significant digit (LSD), since if it were wrong, say by one, we would at least be next door to the right apartment.

In memory addressing, the least significant digits (like the 83 above) could specify a address in any of the memory chips. We depend on the most significant digits (the 2) to specify which chip is wanted, and the others, even through addressed, are not enabled.



Notice connector P303. In the AU-A70, 12K (six 2048 x 8 bit) of program memory ROM and four (two 256 x 4 bits and two 1024 x 4 bits) RAMs are needed. However, provision for expansion is made for more program ROMs and RAMs.

C. Input/Output Ports

The input and output ports are the points at which information is supplied to the processor, and through which the processor controls the VTR units.

They can be classified as: search/select switch input, which comes from the rotary speed select devices; VTR input ports, which monitor the VTR LAMP signals to sense change in mode; the control switch input, which utilizes a scan output to detect operational push button inputs from the user, two VTR output ports, which generate the outputs that actually control the VTR through the 34 pin remote control connectors; and a counter port, which counts the control track (CTL) pulses to be displayed as tape time, and which form the reference for editing.

All of these Input and Output ports are implemented with the 8255, Programmable Peripheral Interface, except the counter, an 8253. The PPI (8255) is a three port bidirectional device with one split port, a two bit port select (address) input, an eight bit data bus (bidirectional) connection, and a chip select input.

Programmable Peripheral Interface 8255

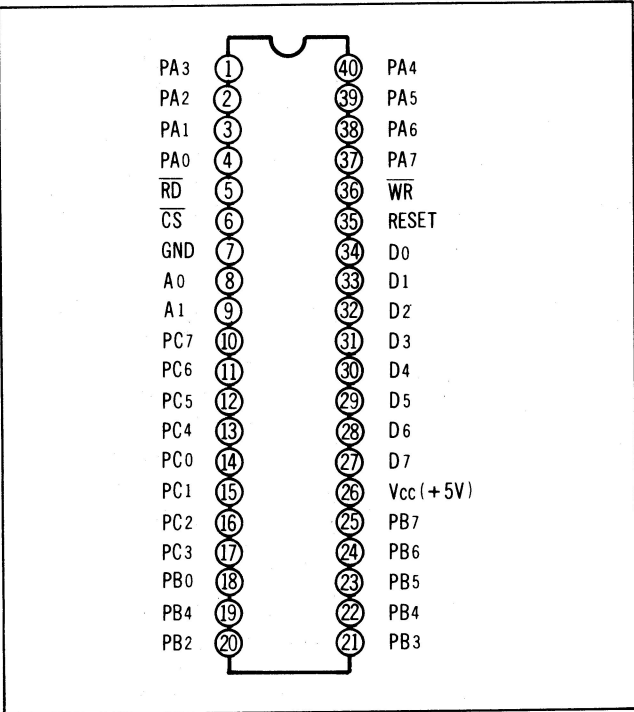


Figure 3-18

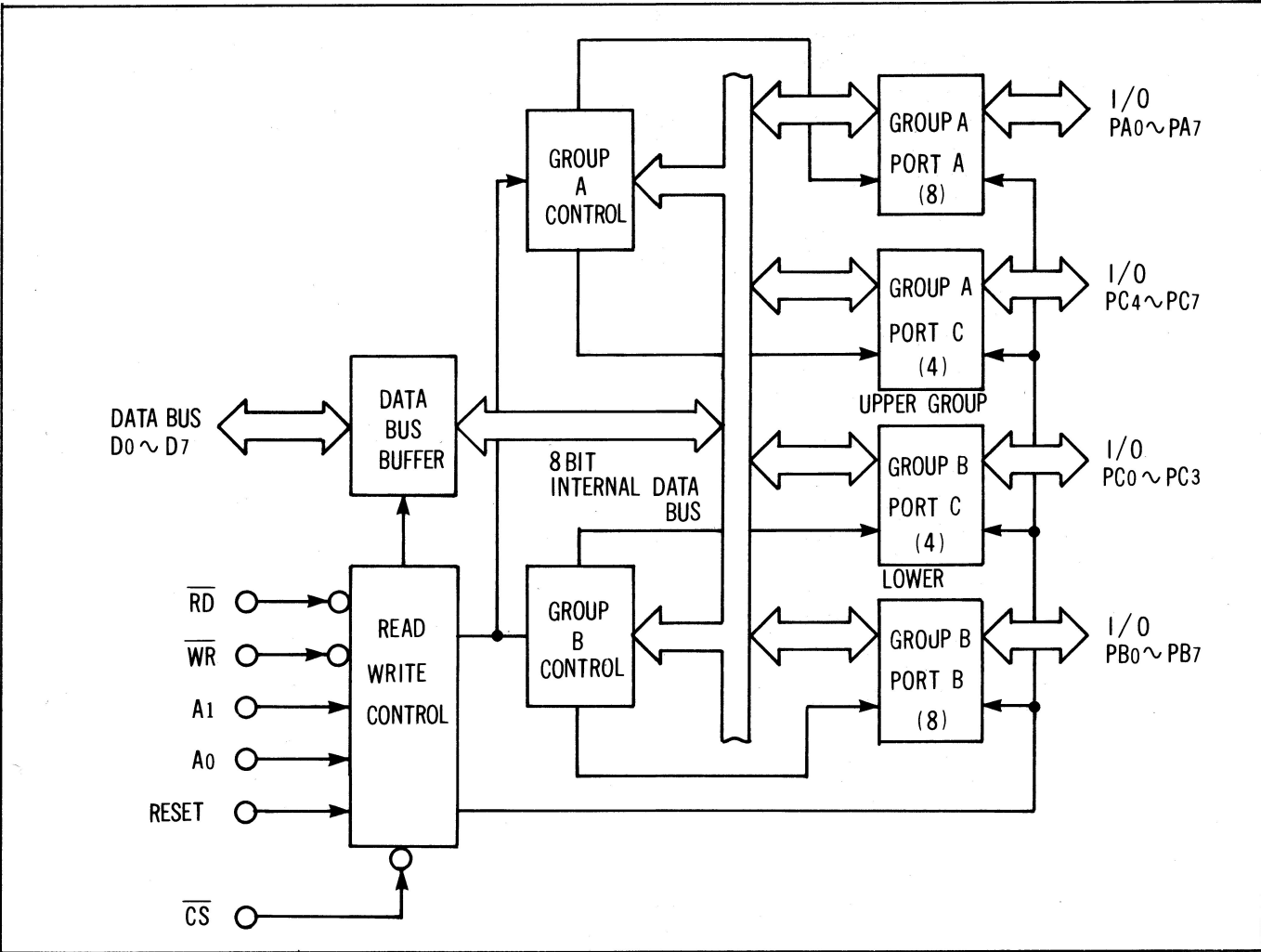


Figure 3-19

A1	A0	RD	WR	CS	OPERATION	
0	0	0	1	0	PORT A → DATA BUS	INPUT (READ)
0	1	0	1	0	PORT B → DATA BUS	
1	0	0	1	0	PORT C → DATA BUS	
0	0	1	0	0	DATA BUS → PORT A	OUT PUT (WRITE)
0	1	1	0	0	DATA BUS → PORT B	
1	0	1	0	0	DATA BUS → PORT C	
1	1	1	0	0	DATA BUS → CONTROL	
1	1	0	1	0	INHIBIT	
X	X	X	X	1	DATA BUS : HIGH INPEDANCE	
X	X	1	1	0		

Figure 3-20

The 8255 is capable of several complex modes of port and peripheral support, which are beyond the scope of this manual, but the modes are selected by a data word sent into the data input when both port select bits are high in the write mode. (See Fig. 3-20) Note than in this system, A0-A1 come from address bit 0 and 1 (AB0, AB1). Since this means all I/O ports share the port select data, an external logic circuit uses the more significant bits of the address bus to be decoded into exclusive chip select (CS) commands which enable the correct IC. (See Fig. 3-21) IC356,357 and 344 (74155) perform this select function, not only for the 6 I/O ports on the MCPUI, but provide for system expansion by providing outputs for CS5 to CS9 at P306, which accompany the buffered AB0, AB1 for chip level port select. (See Fig. 3-22)

ADDRESS BUS	A2	A3	A4	A5	A6	A7
IC369 ⑥	0	0	0	0	1	1
IC365 ⑥	1	0	0	0	1	1
IC358 ⑥	0	1	0	0	1	1
IC305 ⑥	1	1	0	0	1	1
IC319 ⑥	0	0	1	0	1	1
IC368 ②	1	0	1	0	1	1

Figure 3-21

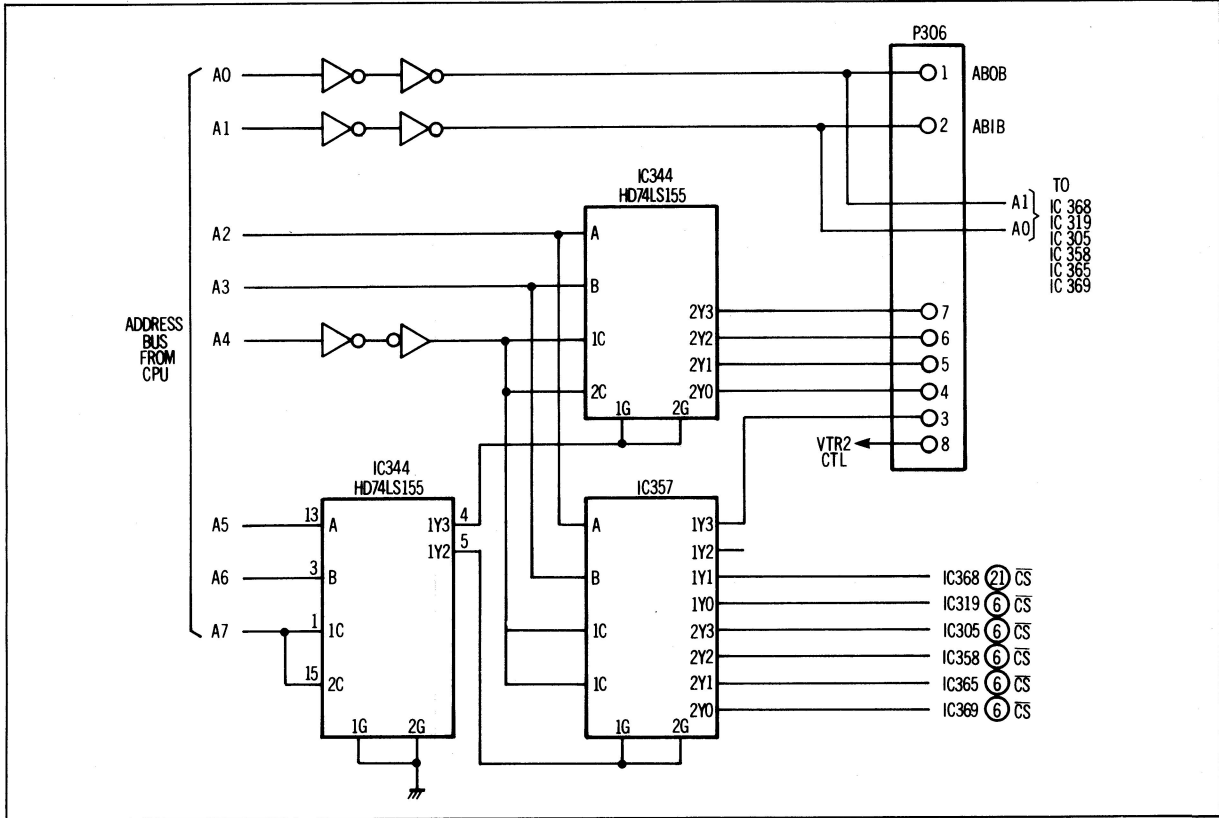


Figure 3-22

Inputs Ports

Search Speed Select

In the search mode, two rotary controllers (one for the Source, one for the Editor) are enabled, which the user turns to select any of five speeds, forward or reverse. The mechanism which allows this is a spring loaded dial with a slotted opaque disk between 5 led light sources and 5 photo sensors. As the disk is turned by the user's knob, a different pattern of slots appears, allowing the LED to shine on the photo sensor.

Pause, the center of rotation, is the auto return point. The five detectors generate a five bit code, which is then sent to IC358 to be an input to the system. (See Fig. 3-23) This port also shares the rear panel VTR model select switches. These switches allow the Edit Controller program to know what unit limitations apply, by model. See Fig. 3-24.

	REV					PAUSE	FWD				
	× 5	× 2	× 1	× 1/5	× 1/20		× 1/20	× 1/5	× 1	× 2	× 3
a	1	1	1	1	1	0	0	0	0	0	0
b	1	1	0	0	0	1	0	0	0	1	1
c	0	0	0	1	1	1	1	1	0	0	0
d	1	0	0	0	1	1	1	0	0	0	1
e	1	1	1	1	1	1	1	1	1	1	1

Figure 3-22

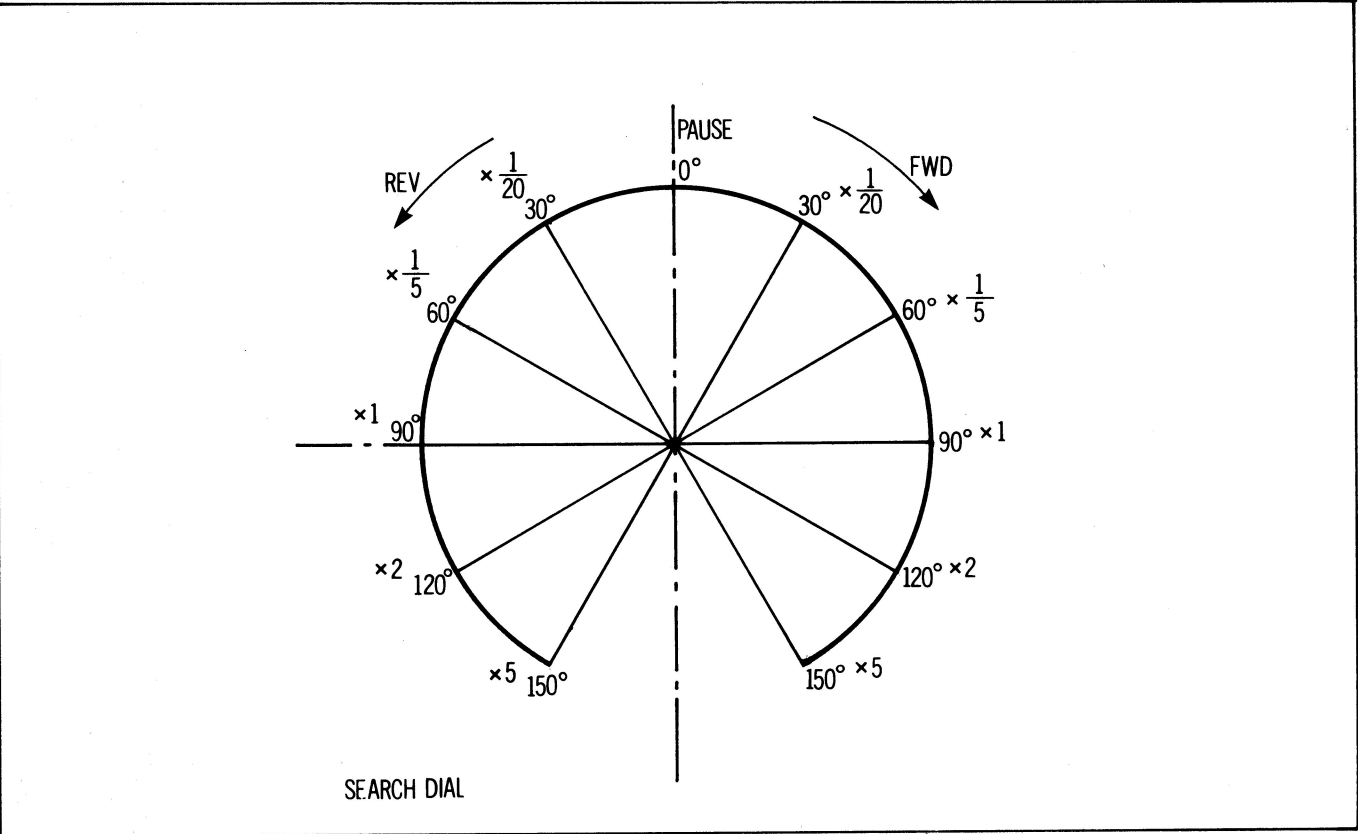


Figure 3-23

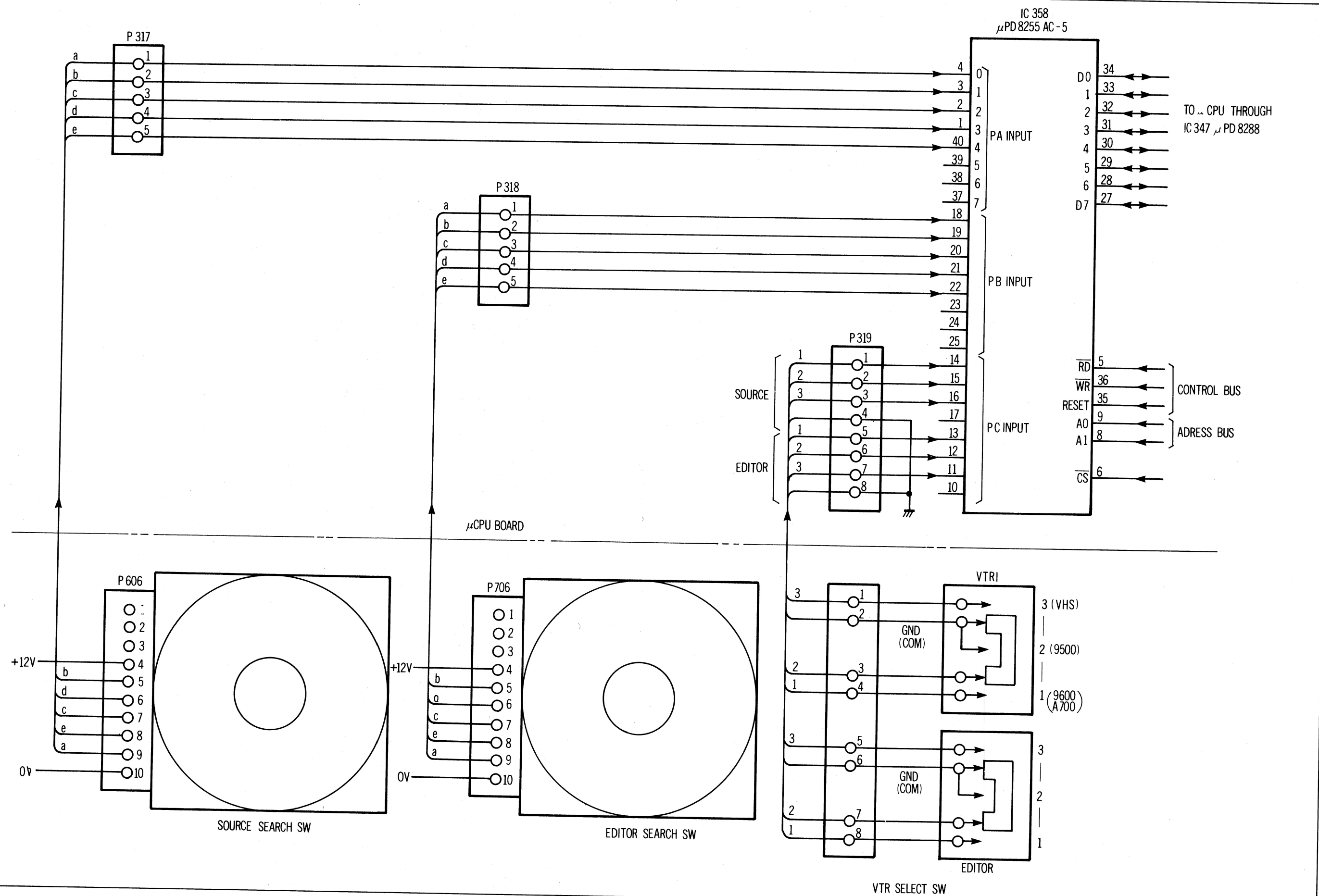


Figure 3-24

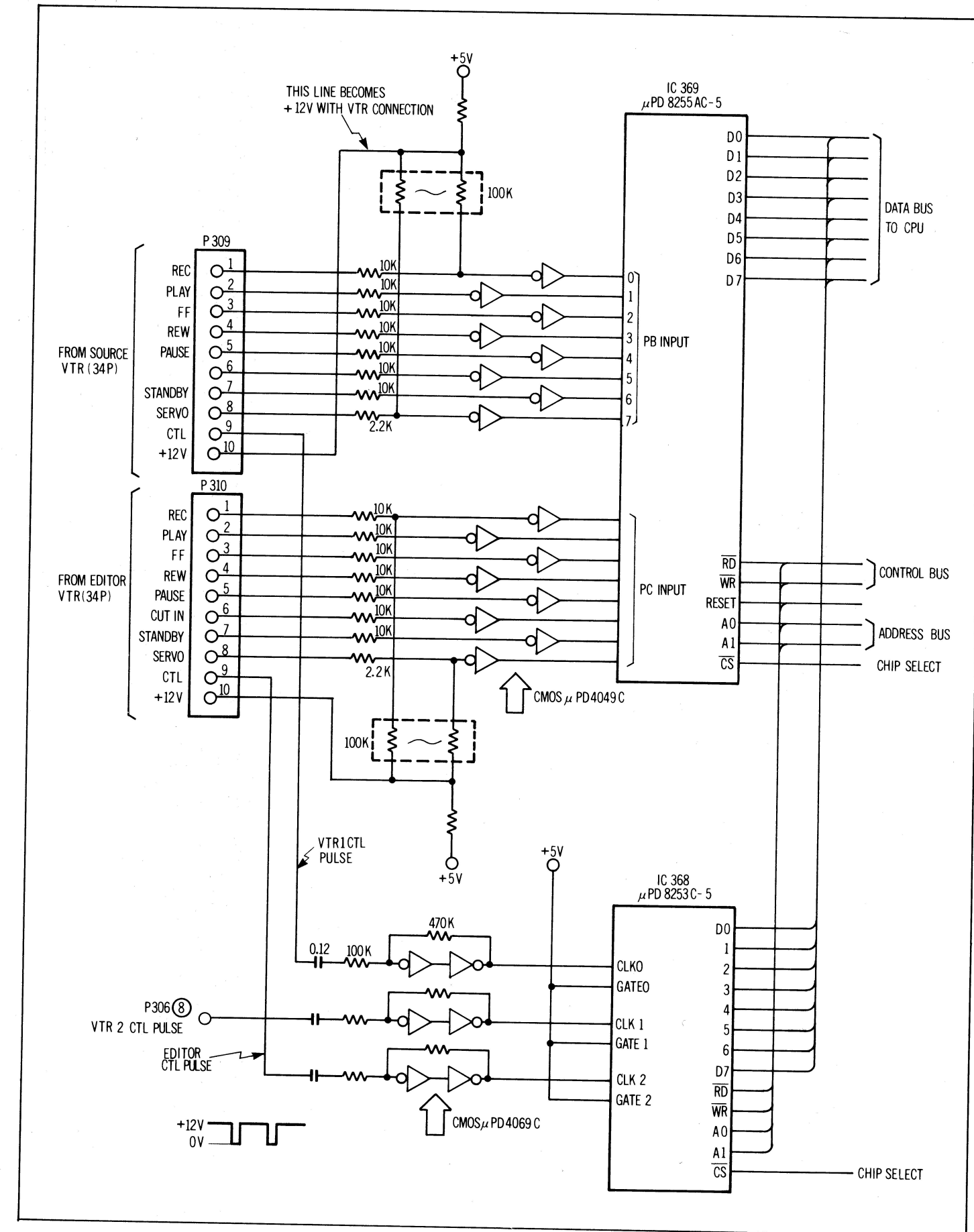


Figure 3-25

VTR Lamp Detect

Since the control buttons on the Source and Editor VTR are not inhibited, the Edit Controller must have a way to confirm the machine mode, and to detect operator changes made at the VTR (rather than at the Controller). IC369 forms an input port for the Lamp drive signals from the two VTRs. These inputs are non-compatible in level, and must be buffered by IC370, 371, 372. (See Fig. 3-25)

The VTR outputs are active low, so RA301, 302 provide pull up resistors, which in turn are resistively coupled to the +5 volt supply. When the VTR is connected, this common point is raised to +12 volts (from the VTR). The counter port shown here will be described below.

CONTROL SWITCH SCAN

All of the front panel mode select and VTR operation select switches are actively scanned. This means that the switch closes a circuit not to ground or a power supply, but to a constantly changing data output of the CPU system. The system sees or senses which output (in time) was fed back to the input where the switch is located, and it decodes this to detect the mode desired.

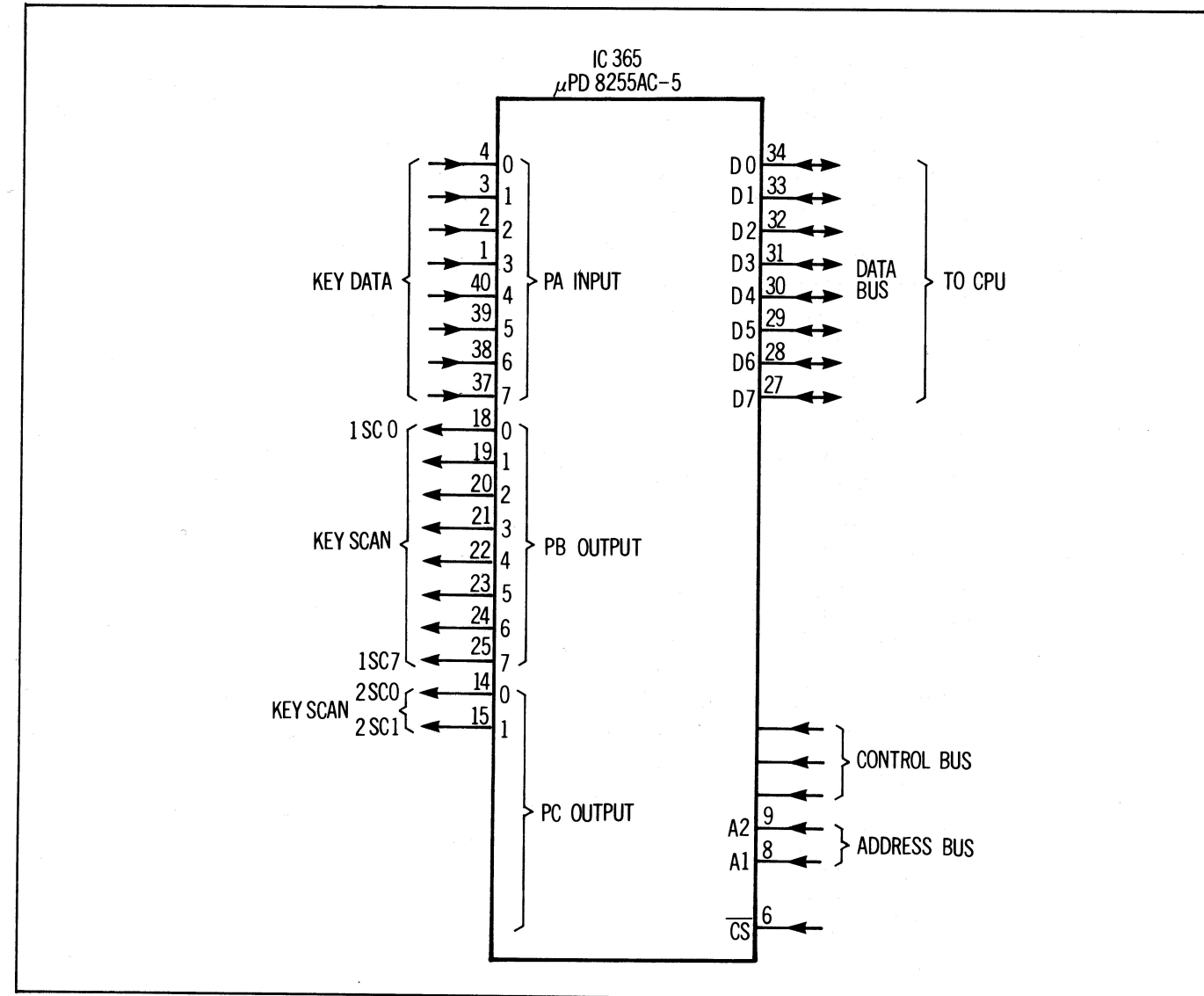


Figure 3-26

Key scan data 1SC0 ~ 2SC1 are outputs from port B (Pin 18 ~ Pin 25) and Port C (Pin 14 ~ Pin 15) of IC365 sequentially generated by the microcomputer processed program. (See Fig. 3-26)

The key inputs are grouped into eight, and form a bus which returns to Port A of IC365. These inputs are normally high, and the outputs not active are also high. However, when a scan data output goes low, and a key is depressed by the operator connected to this scan data output, the corresponding input bit also goes low. This is sensed by the program, which knows which data out was low and hence knows what switch was pressed. One scan cycle takes from 5 to 30 milliseconds. (See Fig. 3-27)

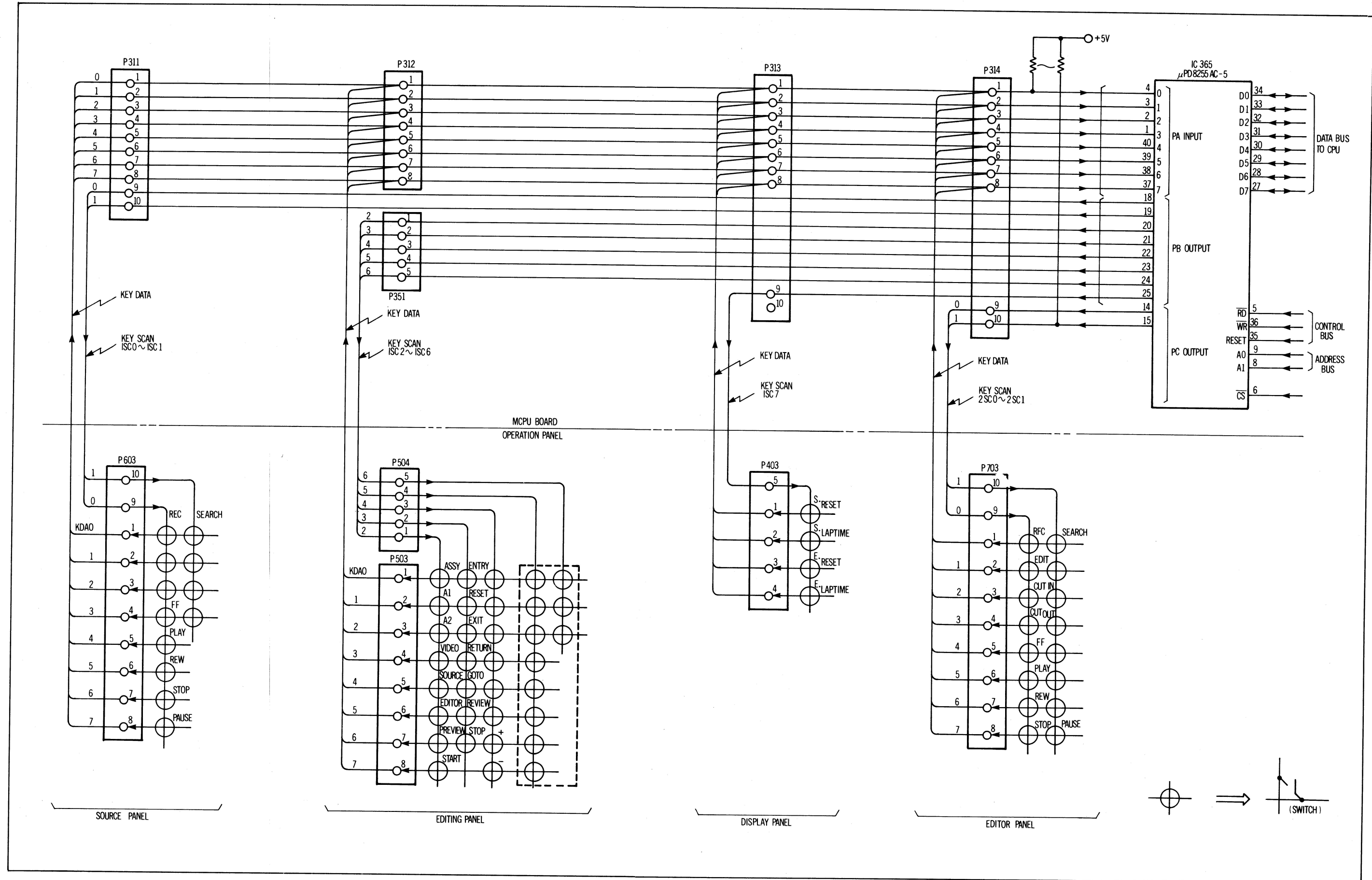


Figure 3-27

For example, follow the pressing of the "ASSY" button. The scan cycle is constantly being gone through. After the ASSY button (S501) is pressed, the key data KDA0 will become low the course of scanning (ISC2 timing). This means the following 8 bit signal appears as the key data input: 01111111

It is supplied to the CPU, and the data is judged as to what key was pressed.

The microcomputer will recognize "FE" and begin the ASSY mode. All key data uses the same process.

COUNTER PORT

In order to know where the tape is, both the operator and the system need to know the present tape time. This is done by counting control track (CTL) pulses, which occur at a 30 Hz rate, and storing this data. IC368 is an 8253, a three section (16 bit per section) counter which can be loaded from the data bus or read out to the data bus. These counters are decrementing, and can be read to the data bus even as they count. This makes an ideal unit for CTL counting because the CTL pulses do not occur in any fixed phase or time with the actions of the CPU group.

The system side appears very much the same as the 8255, with two port select bits (A0, A1), chip select (CS) read and write control inputs and the eight bidirectional data bus connections. The CTL pulses are passed to a Schmitt trigger prior to the counter. One counter exists for VTR2, not used in this edit controller, and one each for the Source and Editor. (See Fig. 3-25)

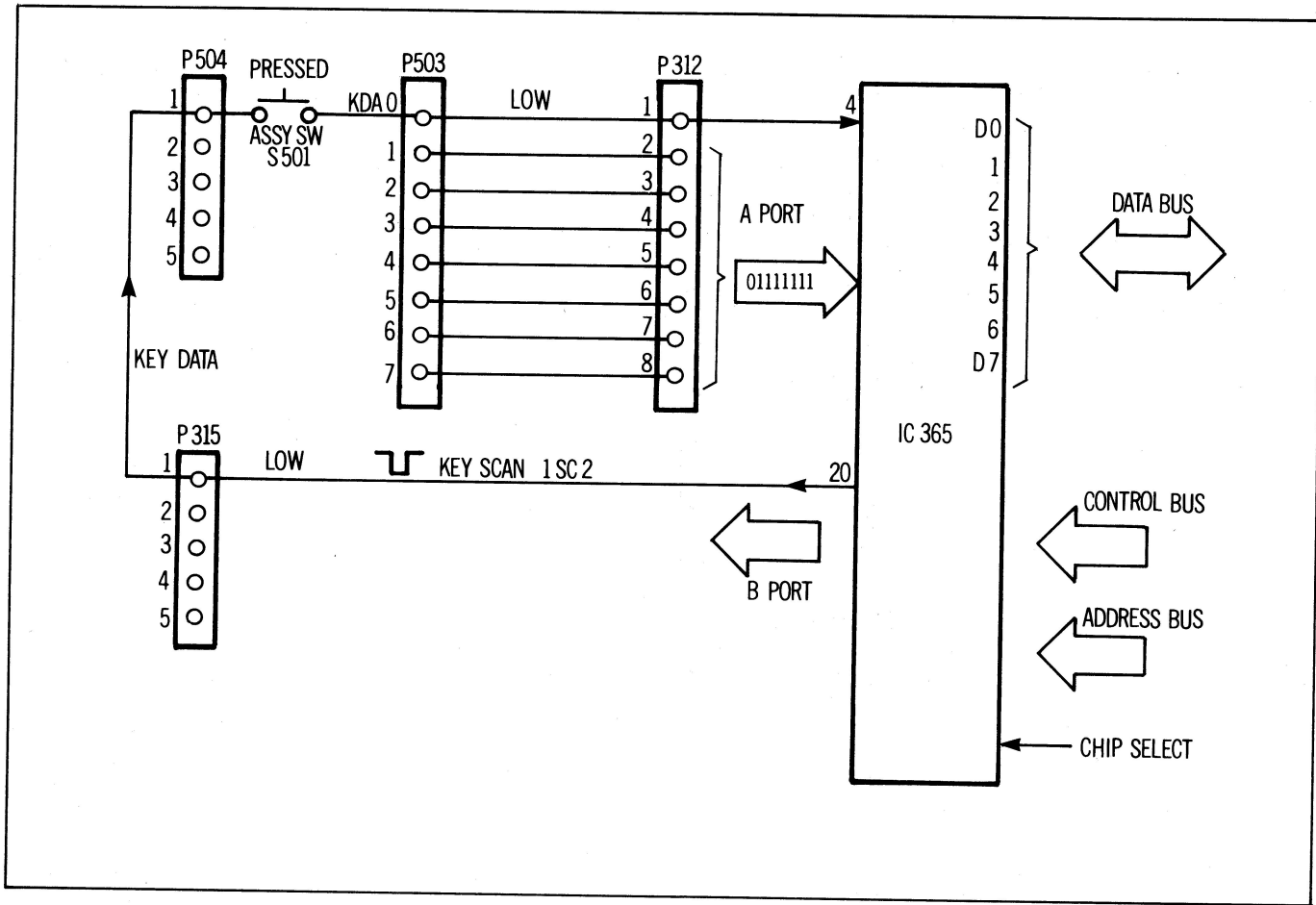


Figure 3-28

Output Ports

Two 8255 PPI ICs are used for VTR control outputs, and all three ports of each is used as an output. IC305 provides the Source outputs, and IC319 the Editor outputs. The data bus, control address and chip select all function as for other I/O ports. Since the output functions are identical, only the Editor is shown. The port A, B and C outputs are buffered by IC301, 2, 3 and 4 (IC321, 2, 3, 4-Source), which are open collector level buffers. The outputs to the VTR are active low.

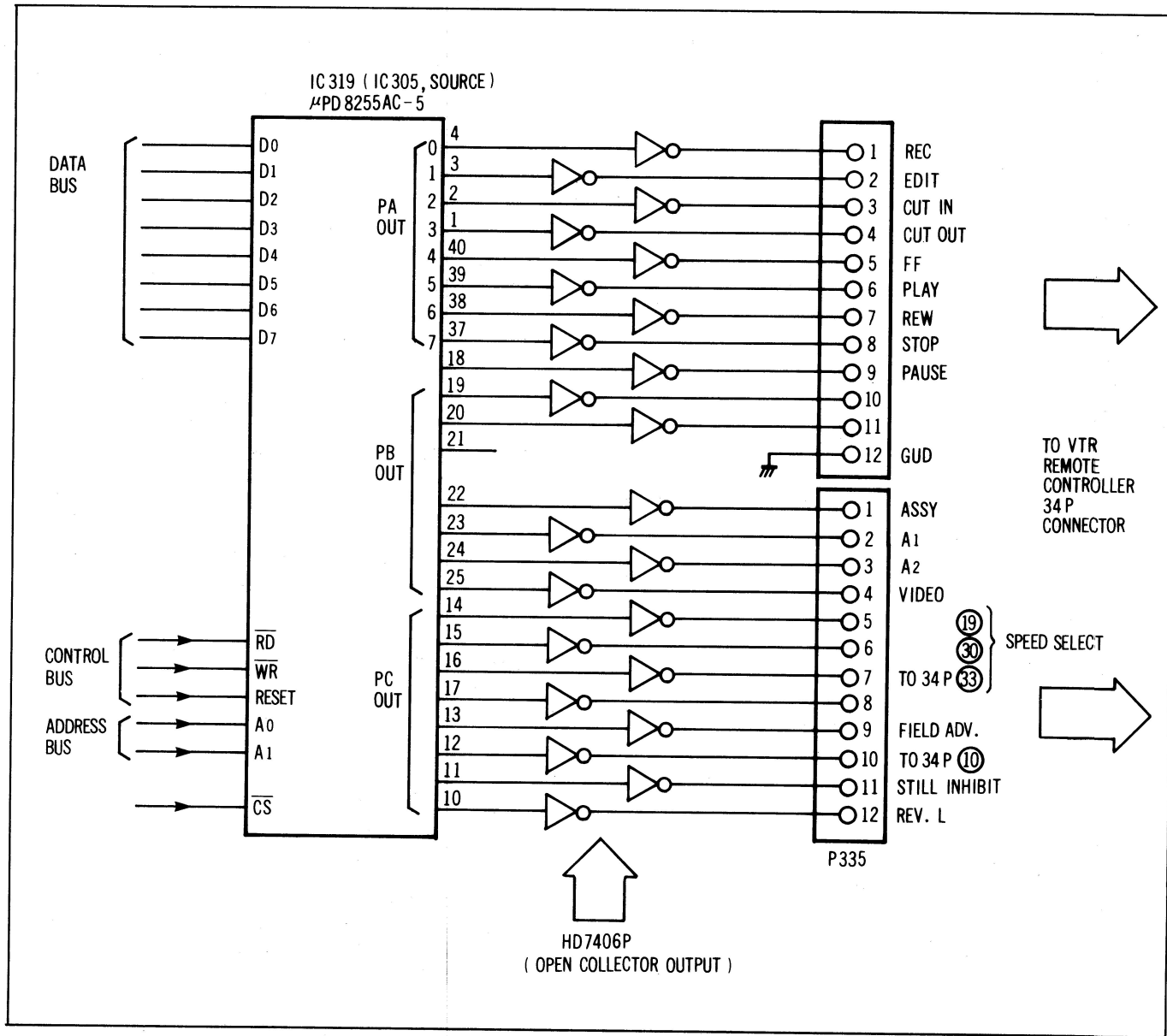


Figure 3-29

Display System

Direct Memory Access (DMA)

Direct memory access is a technique widely used to accomplish a data transfer in microprocessor based systems where the use of the processor to perform the transfer would be either too slow or consume so much of the processors capability that a bigger or faster unit would be required.

The basic technique is simple-the device needing the data asks the processor to go into Hold, where all operation is suspended and the data and address bus are floating, it then takes over those buses, addresses the memory and sequentially gets the data. When it has the data, it releases the hold and the processor resumes operation. In the edit controller, all the display devices, both time digits and function LEDs, are driven by a display system which uses DMA.

The key is that the DMA system must know where the data is stored in memory, the processor must keep the data in the proper line in the correct format, and the display system must be organized to easily use the data from memory. This requires understanding three concepts at the same time; display drive, memory location, data transfer. First, consider a simplified seven segment digital display, as shown in Fig. 3-30.

The individual LED elements are grouped to form a pattern that allows any decimal number to be formed by selective illumination. Each LED, or segment (a-g), and the decimal point (h) have a driver. This means that all the decimal displays can be made by one 8 bit number sent to the drivers. For example "Zero" would require 00111111 (or BF in hex).

This means that the processor does not store the actual number for the display, but the segment drive information as segment on or off (1 or 0). The translation from time to segment drive is done in the program software.

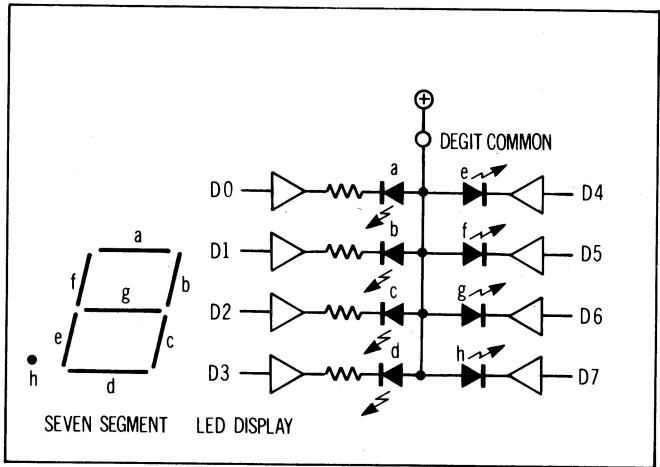


Figure 3-30

In fact, in each display group (Editor and Source) there are eight digits, each with seven segment and decimal point. All the segments are in parallel and the digit common(s) are separate, so only one digit is enabled at any time. If this is the Source side, for example, it is called the First Lamp Drive group (1LD). There are four LD display groups.

Second, consider that among the 256 lines of RAM memory, which has 256 address codes, the programmer may pick 64 addresses to hold the display data, in 4 groups of 8 addresses. Remember that each address holds 8 bits. This is shown in Figure 3-32.

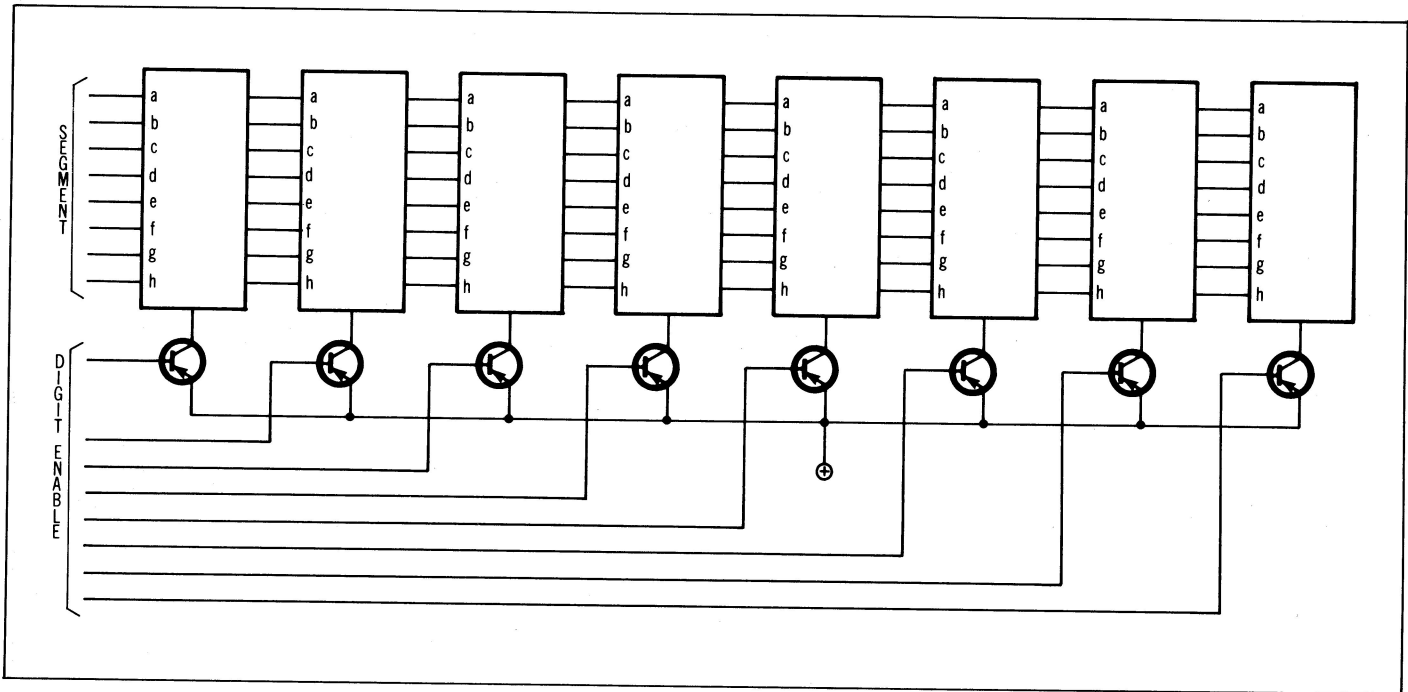


Figure 3-31

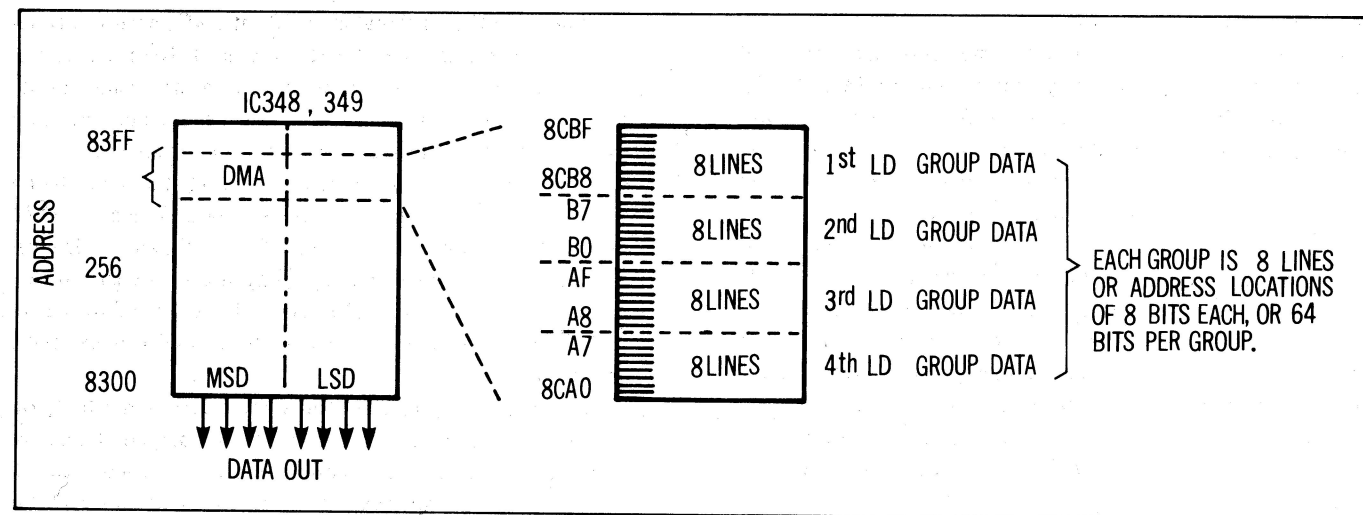


Figure 3-32

It can now be seen that the data and the display are designed to compliment each other. The data must be transferred from memory to display drive, and stored.

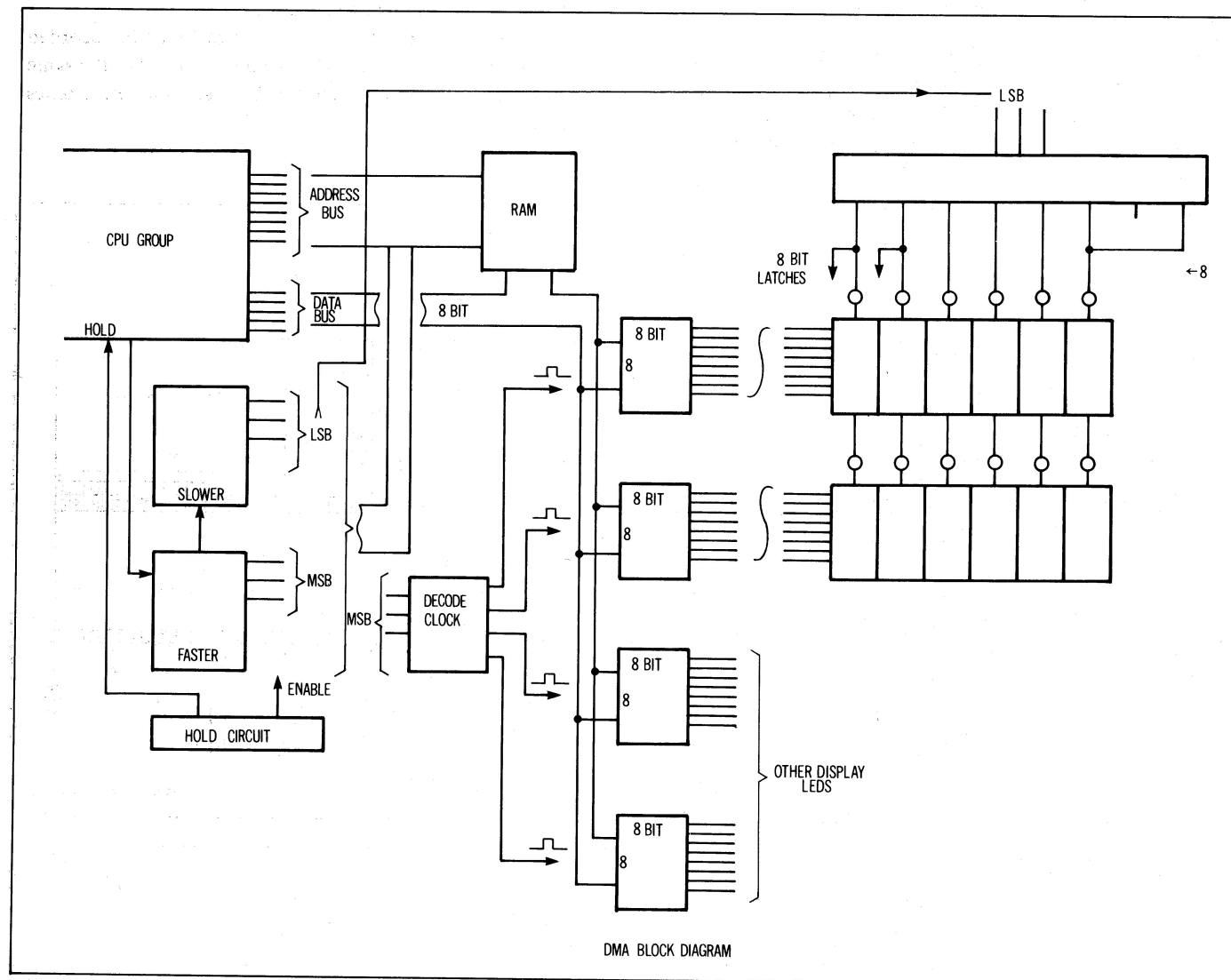


Figure 3-33

At the end of a number of CPU group clock pulses (1000), the Hold circuit requests a hold. When the processor finishes the instruction it is then performing, it generates a Hold Acknowledge and floats the data and address buses. The hold acknowledge (HLDA) enables the DMA address gates, which can then output their own address codes. The CPU clock is used to coordinate this process by using binary ring counters, which when fed clock pulses simply count up in binary, one count at a time.

Since the faster counter is used for the more significant digits, the address count moves from the first line of the first group to the first line of the second group, and then to the first line of the third group, and on to the first line of the fourth group. While the address is at each of these points, the data at that location is available on the data bus. A clock pulse to one (of four) of the 8 bit latches stores the data, and when the address changes, the next line of data (actually, the same line(0-7) but from a different group (1-4)) is made available and then stored by a different clock pulse. In sequence then, four eight bit codes are transferred to four 8 bit latches, and then the Hold is released. The LSD counter will advance, and the process will begin again for the second line of each group in 1000 clock cycles, or 2 milliseconds.

While that two milliseconds time is elapsing, the four 8 bit data groups now stored in the latches are used to drive the first digit of each of the display LD groups. This requires that the digit enable is made from the LSB counter, since it "knows" (holds) the count that directed which line of each group was transferred. In this fashion, the transfer is self-correlating-the line count (8 lines per group) is the same as the digit count (8 digits per LD group). Because there are only four groups of data and LD groups, the MSB counter is reset and held until the DMA sequence begins again.

NON-DIGIT DISPLAY

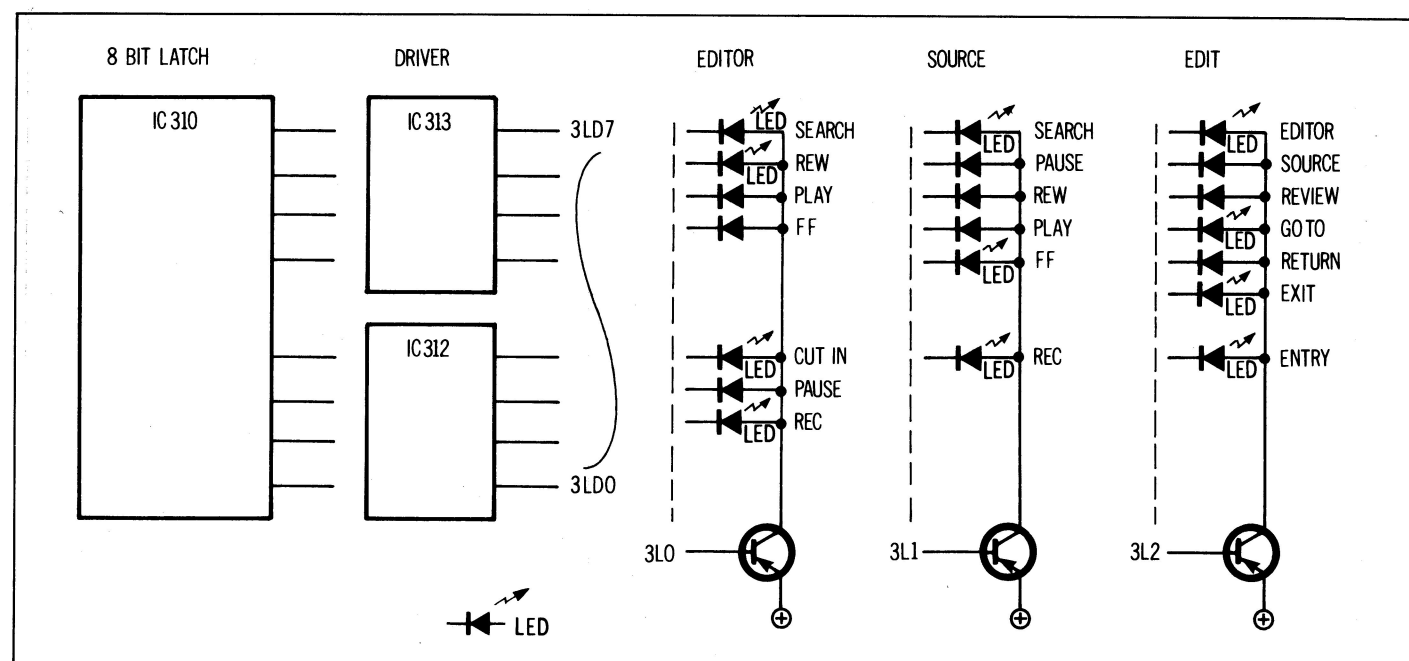


Figure 3-34

The lamps (LED) for the various mode buttons, both for the VCRs and also for the edit select and process controls, are treated as if they were seven segment displays, and multiplexed in the same fashion. They form Lamp Drive (LD) groups 3 and 4. This is shown in Fig. 3-34.

DMA-Detailed Description

By observing the schematic in Fig. 3-36 and the timing chart given in Fig. 3-35, one can see the input from the CPU group (IC345-6), the $\phi 2$ TTL clock. This goes to three decimal counters ($\div 10$) 7493, which also have a B input for divide by 8 (See Fig. 3-37). As block diagram shows input A is counted down into 1/2 at QA, 1/4 at QB, 1/8 at QC and 1/16 at QD.

The 1st flip flop in IC326 toggles at the 2 msecond rate. When OK1 is high (IC326-3), and the next 2μ Sec./clock comes to (IC326-9) the second flip-flop, the hold input is generated.

The CPU clock $\phi 2$, 0.5 μ sec from IC345-(6), μ PD8224 is supplied to IC324-(14), HD7493A which is 4-bit Binary counter.

This OK1 data appears at IC326-(5) as a OK2 signal with timing of the falling edge of 2 μ seconds pulse.

As a result, OK1 and OK2 signals are nor gated at IC328-(9) and (10) to produce the HOLD signal at IC328-(8), Fig. 3-35 (4). The HOLD signal will be supplied to the CPU, IC346-(13). When the CPU receives this HOLD, the CPU sends out HLDA signal at IC346-(21), Fig. 3-35 (5). Then DMA control logic circuit starts. The address signal (AB0 to AB6) at the address bus selects the DMA by pulling down the lines, which otherwise float high, with open collector gates IC336, 337. Then a proper address appears on the address bus and data on the data bus and it is latched by ICs IC307 ~ IC310, 8212. The 8212 is an 8 bit I/O port and performs as a data latch and buffer, with a block diagram in Fig. 3-37.

The outputs of IC307 are supplied to the time display board, VEP2006A through P321 and P404 to display the time segments of the Source VTR.

The outputs of IC308 are supplied to the time display board, VEP2006A through P322 and P405 to display the time segments of the Editor VTR.

The outputs of IC309 are supplied to the time display board, VEP2006A through P326 and P406 to drive the LEDs for the time and the lap time indicator for both Source and Editor VTR.

The outputs of IC310-(4) (6) (8) and (10) are supplied to IC316, 74LS175 which is a quadruple D-type Flip-Flop. The D inputs of this Flip-Flop will transfer to the Q outputs by the rising edge of the clock pulse at IC316-(9). The clock pulse is made from AND Gate circuit, IC331-(1) (2) (3) whose gate inputs are 2msecond pulse and the decoded

signals from LDA/LDB/LDC outputs made by IC330, a 74155. The 74155 is described in the memory address section, page 210 and Fig. 3-17.

The outputs of IC316 are supplied to editing board, VEP2007A through P239 and P506 for lamp display: "ASSY", Audio CH1, Audio CH2 and Video. The outputs IC315, IC316 which are D also type flip-flops light both Servo and Stand-By lamp for the Editor and Source VTR. IC314 ~ IC316 are used for latch of the data signal. IC318, 75452, is a high current output NAND driver for the incandescent lamps.

IC312, 313 are 7438 NAND gates used for LED drive for the third LD group. The other identical drivers are on the display board are also 7438, NAND GATE.

The timing chart of the DMA process is shown in Fig. 3-35.

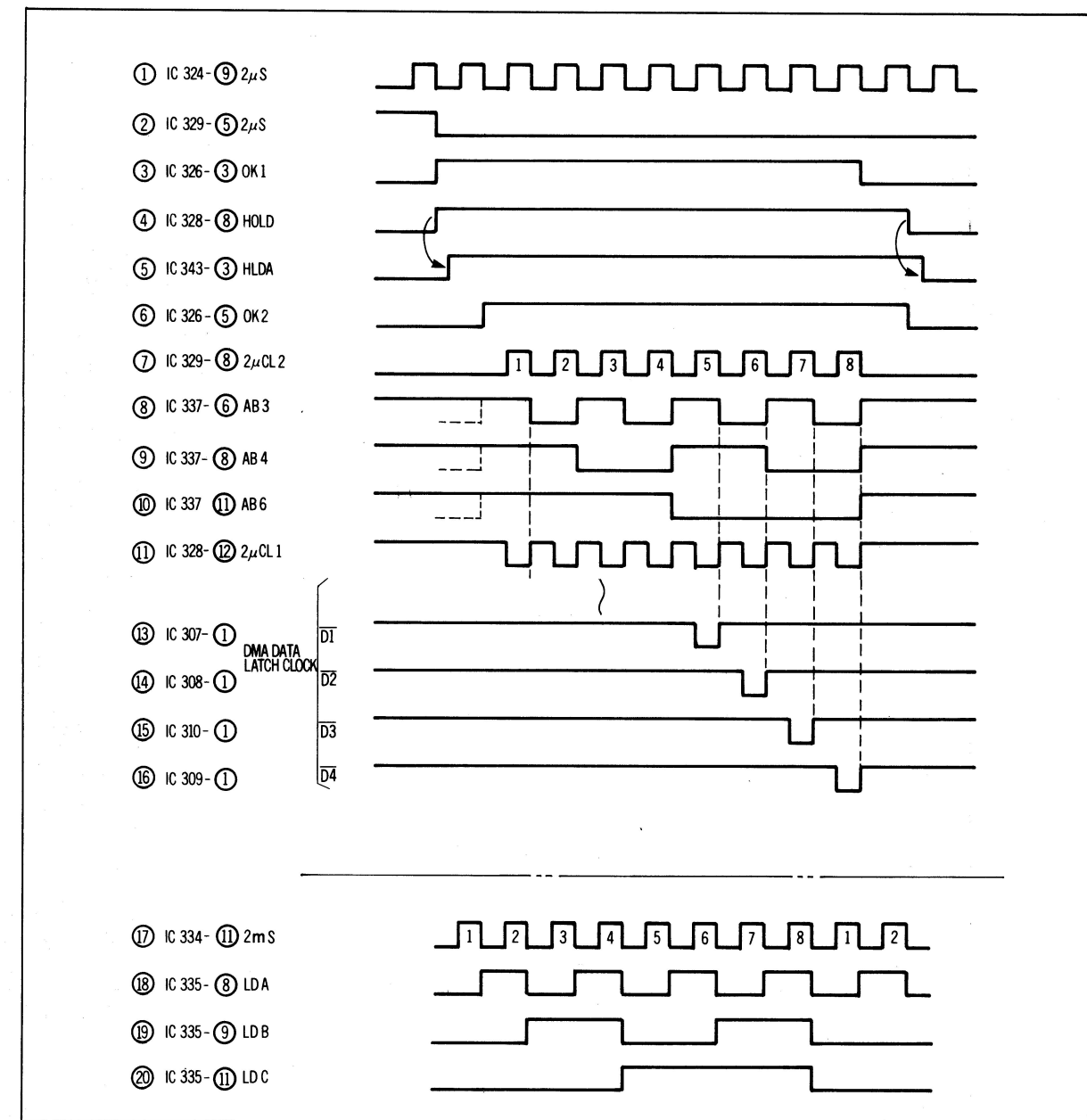
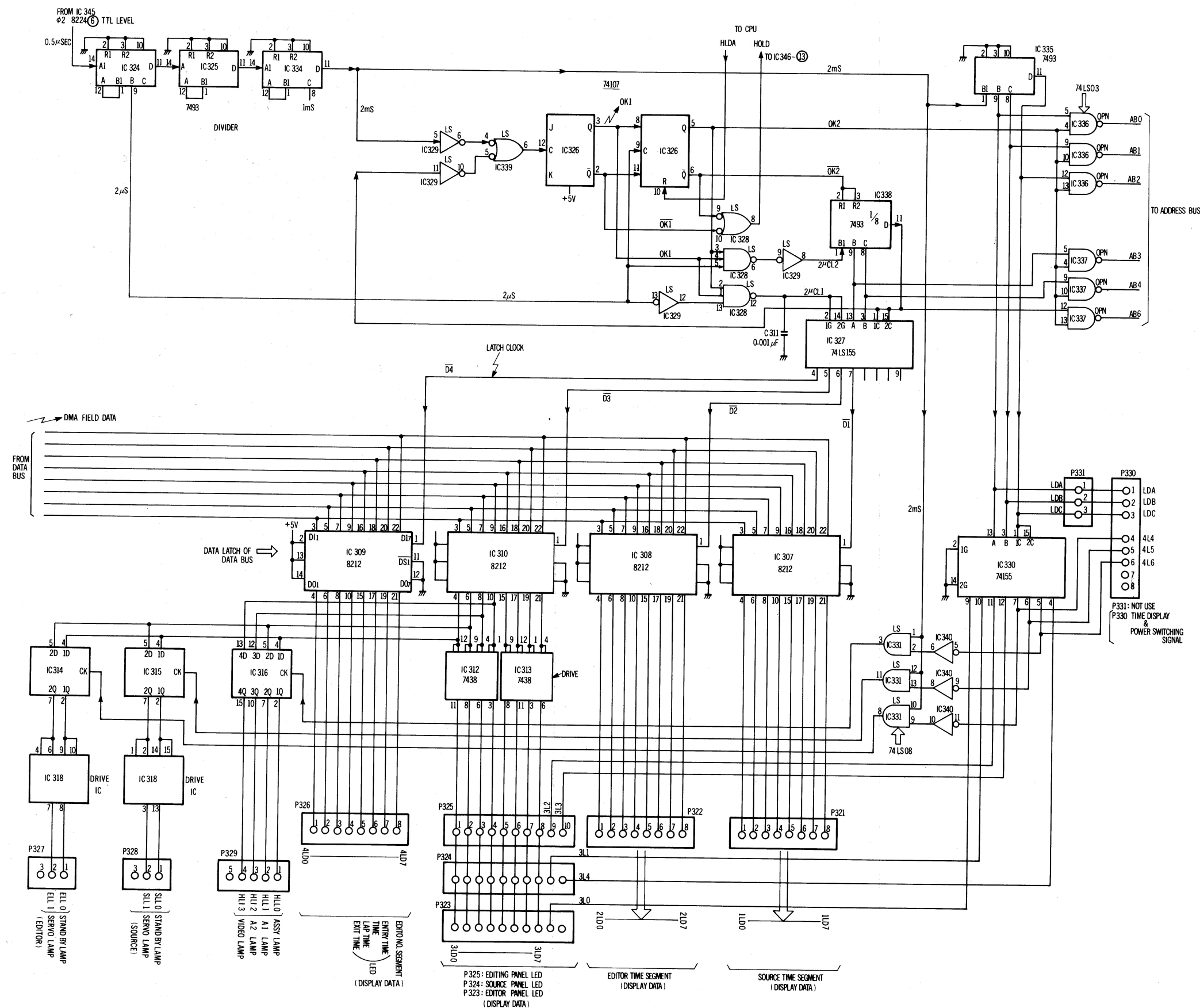


Figure 3-35



SMPTE TIME CODE

The AU-A70 has an internal Time Code Generator and Reader, which formats and outputs standard SMPTE Time Code for recording, and reads and reformats that code upon playback. Prior to the adoption of Time Code, tape editing was performed based on times calculated by counting the 30 Hz control track (CTL) pulses, one per video frame.

If long segment times or many forward/reverse passes (reviews) were needed, this system became inaccurate due to missed counts, mechanical shortcomings and the like. These are overcome by the time code system, because every frame of video has an accompanying group or frame of time code data which identify, in time (hours, minutes, seconds, frames), that frame from all others. Therefore, the edit controller can always drive the tape to exactly the same point everytime.

The time code (T.C.) signal is an 80 bit code, with the functions of each bit assigned by the standard. Notice that un-required bits have been dropped-there are no frame counts over 29, so the frame tens is a two bit space-and the time digits separated by unused (as yet) BCD code spaces.

This allows the sync word, which is a 16 bit code, to be unique, regardless of the time or user data. The sync word begins with 00 (Bits 64, 65), has 12 “ones”, and ends with 01 (bits 78, 79). Since the tape may move in either direction, this difference (00, 01) allows detection of direction to assure proper format - otherwise, hours and frames might be reversed.

The standard also provides for a modulation method, or how the signal shall be recorded and played back. A Manchester I or Bi-Phase coding system is used, and it presents several advantages. It requires no separate clock track to be recorded; the polarity of the signal is not important (a phase reversal is not critical), and the signal can be read at multiple speeds (See Figure 3-37).

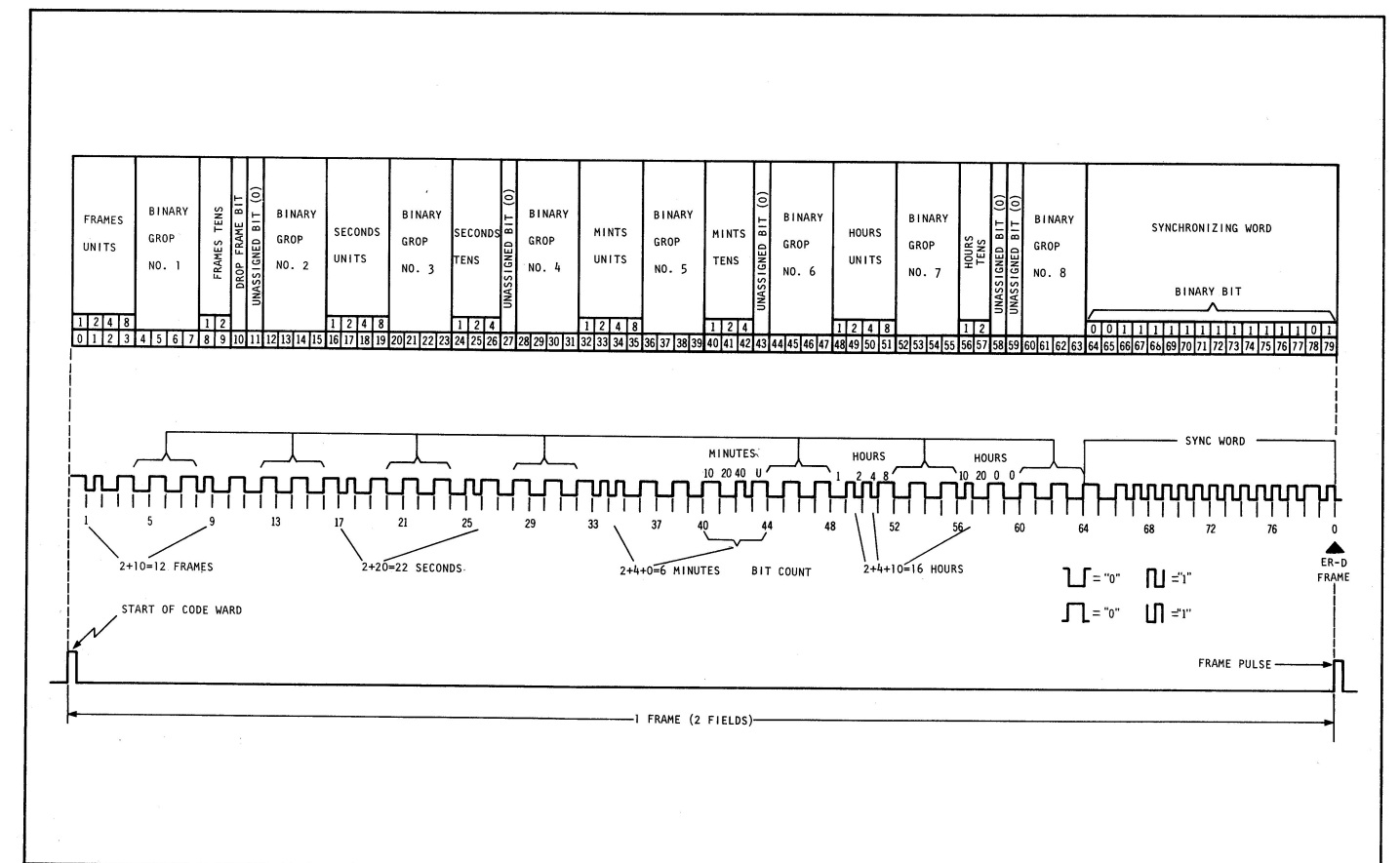


Figure 3-37

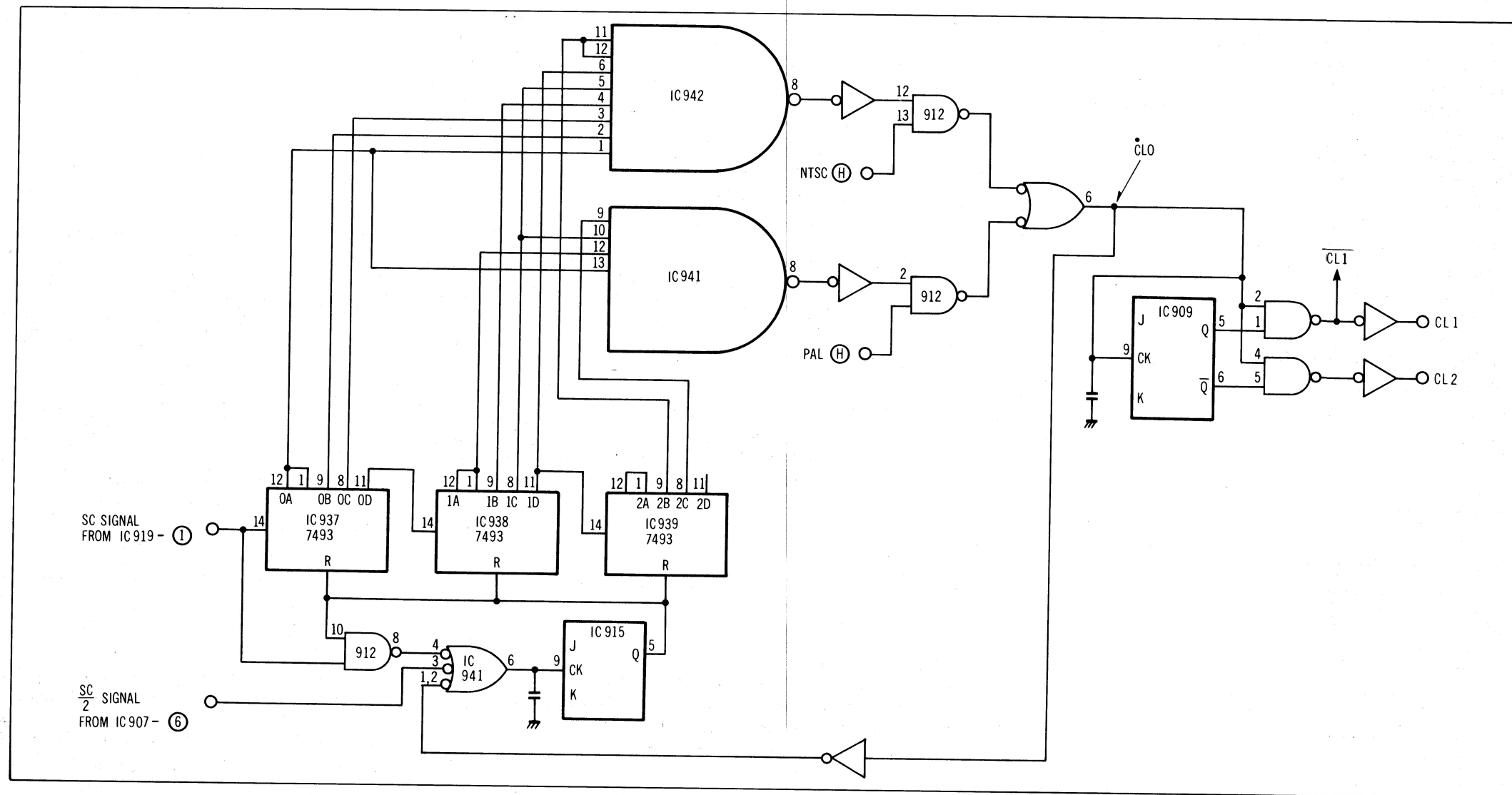


Figure 3-41

Time Code Time Data

The generation of the time numbers and formatting into the groups required by the time code standard (See Fig. 3-37) is done by the microprocessor and program of the edit controller. The time base for the counting is taken from the vertical sync (Int or Ext) at IC914 (8), inverted by IC913-(1)(2), and divided by two (IC908-(3)) to trigger the MMV (IC916-(4)) to produce an interrupt signal every frame, or 30Hz. The processor recognizes the interrupt and counts up the time by one frame. This time data must also then be made into the time code waveform by the generator.

The processor formats the code into ten eight bit words. These ten words are transferred from RAM to the PPI, IC921, Port A, and dumped eight bits at a time into a First in-First Out memory, using IC921 Port C bit 0 as the shift in command for the FIFO (SI) IC920-(17). This is all done by the interrupt sub routine held in the program.

These 8 bit words are in turn clocked out of the FIFO as 8 parallel bits and stored in an 8 bit shift register (IC917, 918) made of two 4 bit units (7495) for parallel to serial conversion. The FIFO memory is a 3351 in which the ninth bit (Bit 8) is not used for this system. See Fig. 3-45 and 3-46.

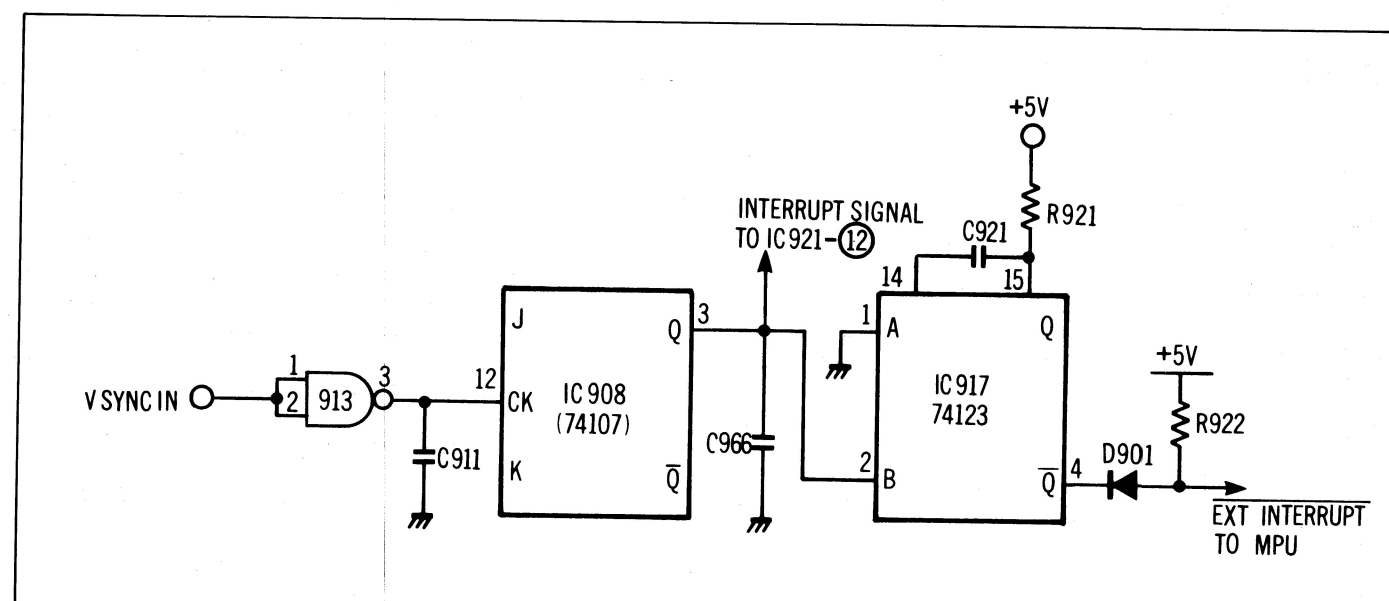


Figure 3-42

3351 (40x9 First-In First-Out Memory)

The 3351 is a First-In First-Out (FIFO) memory used for data rate buffering. The 3351 has a capacity of 40 nine-bit words. The words are accepted at the input, automatically shifted toward the output as new words are clocked in, and removed at any rate in the same sequence in which they were entered.

The 3351 has status indicators on the input (which signals an available empty input, not used here) and output, to indicate a valid data word at the output. It also has separate input and output enable, as well as a control section (not data) master reset (MR).

As is shown in Figure 3-45, the data is held in the FIFO memory, and is available to the shift register in 8 parallel bits. The shift register must have two modes: parallel store, to accept the 8 bit word, and serial shift, to clock out the word one bit at a time through the upper most flip flop output.

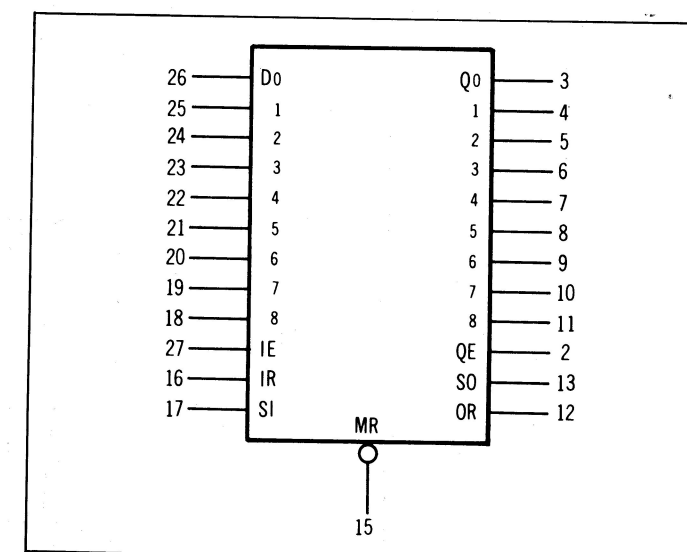


Figure 3-43

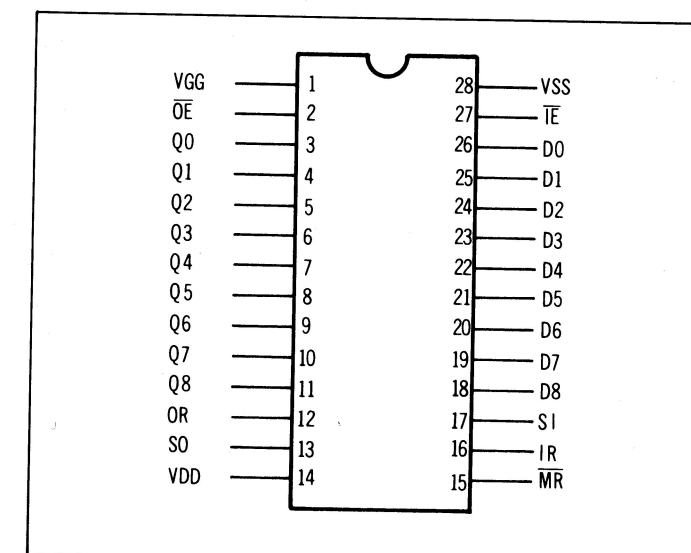


Figure 3-44

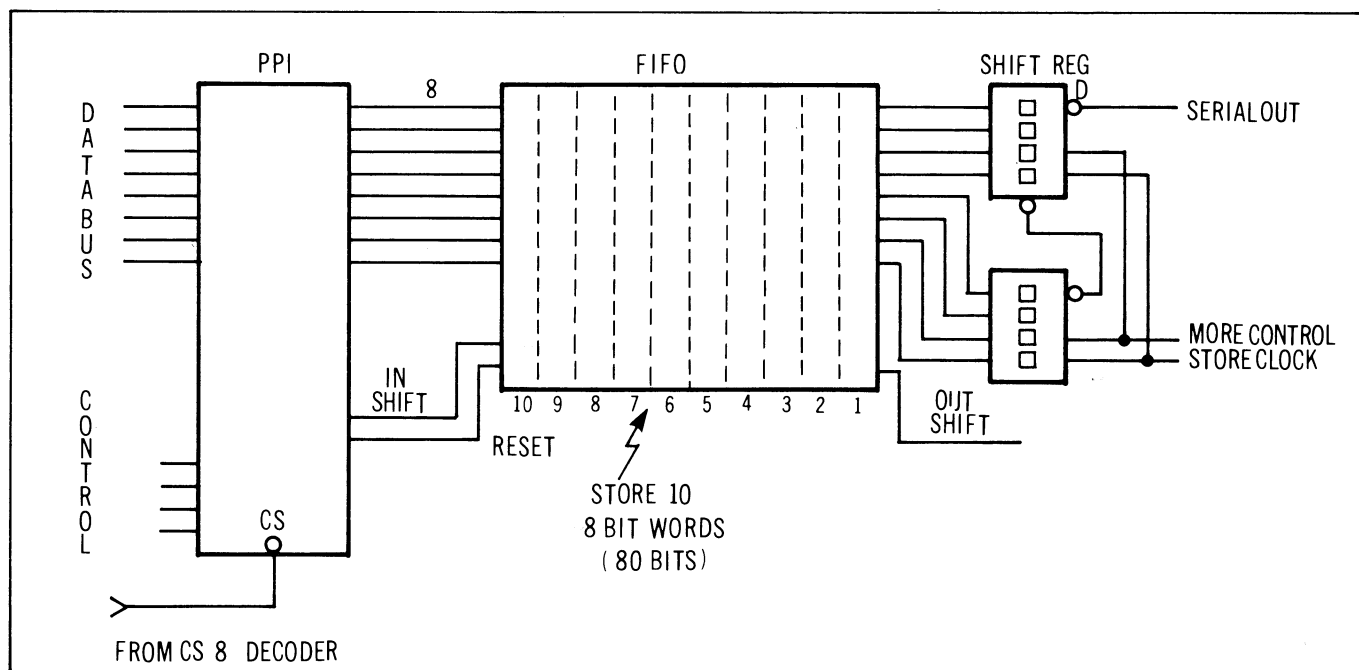


Figure 3-45

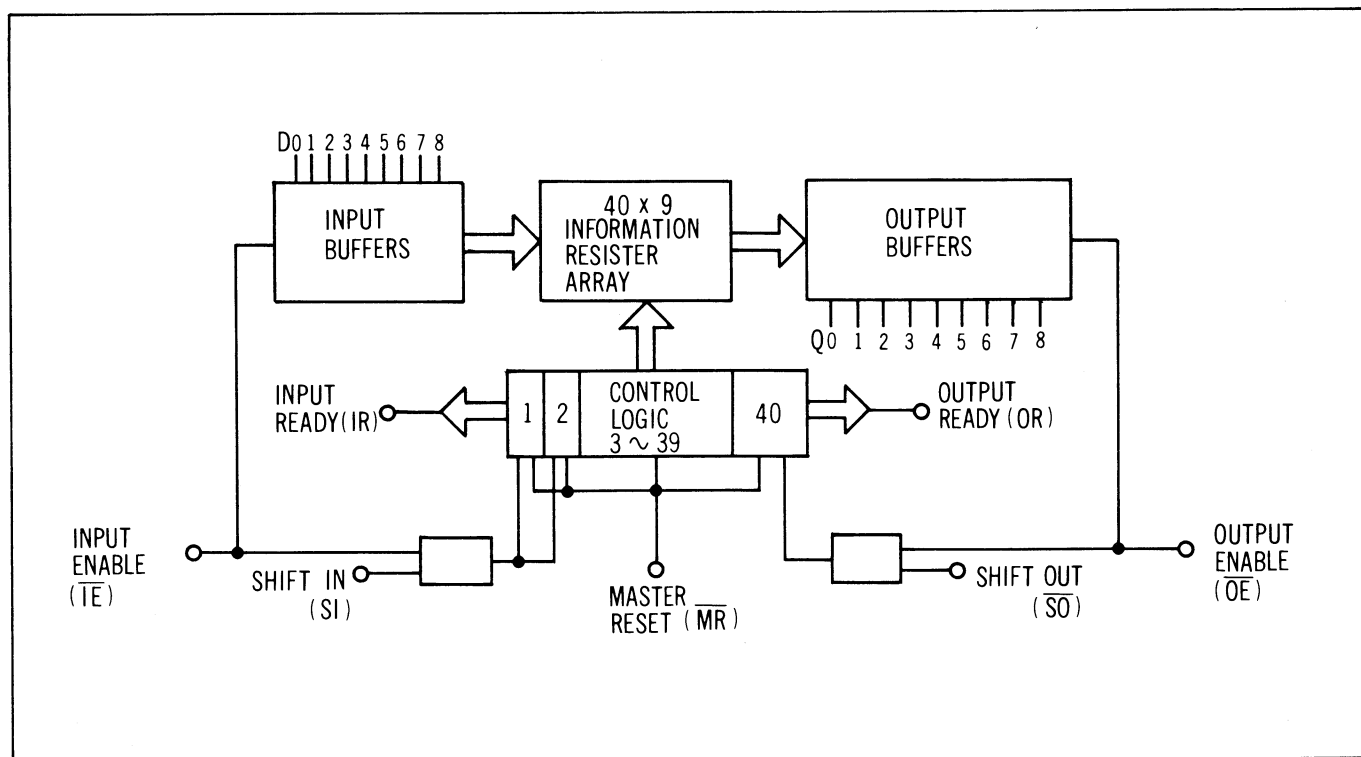


Figure 3-46

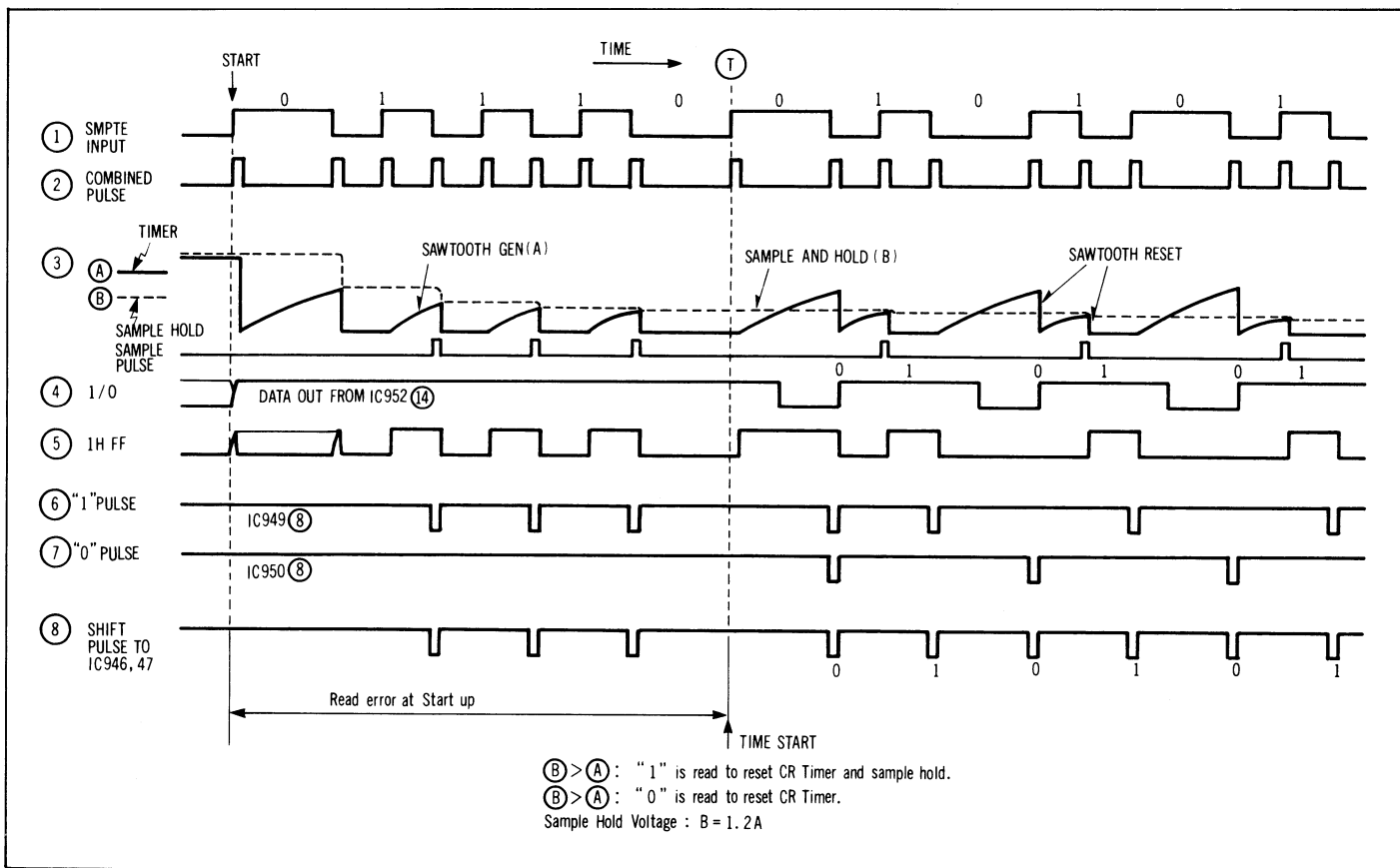


Figure 3-47

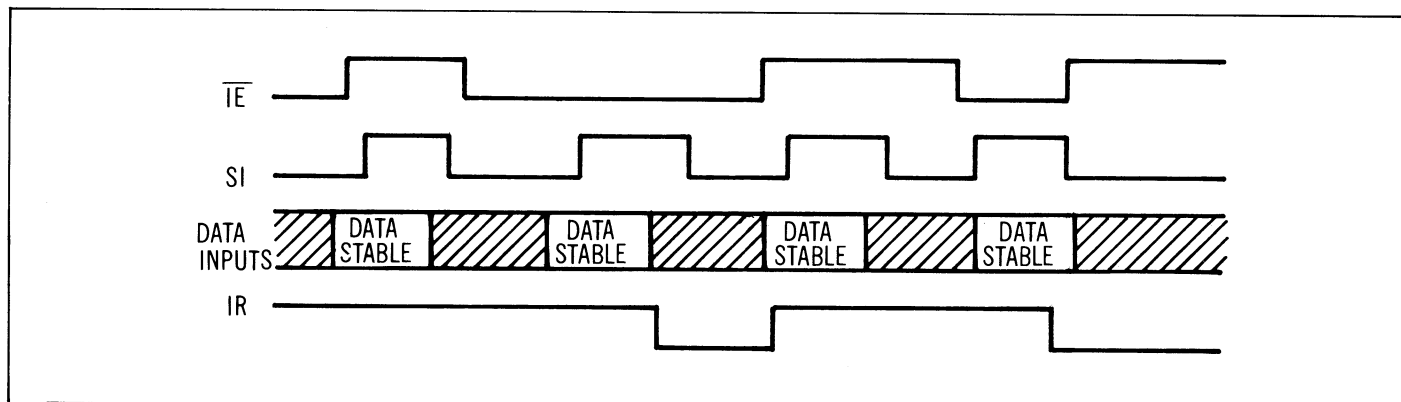


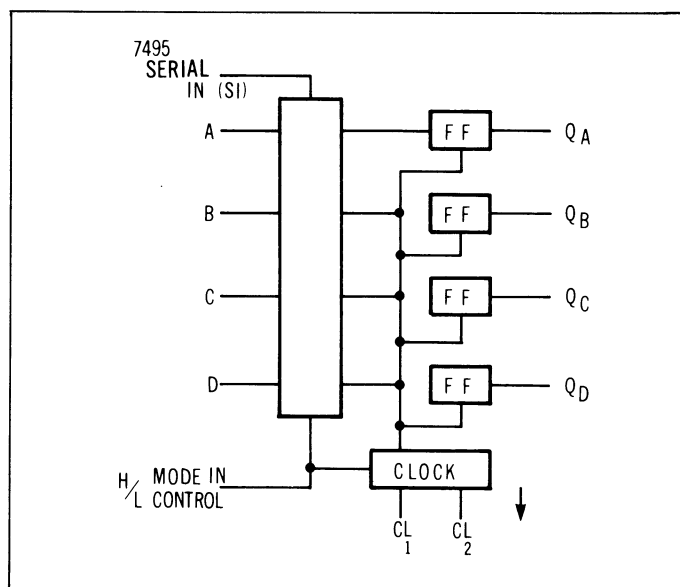
Figure 3-48

When the mode control is held high, a Clock 2 (pin 8) negative transition transfers all the Data (4 bits) at A, B, C and D to the flip flops and to QA, QB, QC and QD respectively.

When the mode control is held low, a clock 1 (pin 9) negative transition transfers the serial input Data to "A" F.F., and it appears at QA. The Data previously in QA will move to QB, QB to QC, QC to QD and the data previously in QD will be lost.

By tying the D output (QD) of one shift register to the Serial input (SI) of another, an 8 bit parallel to serial converter may be formed. See Figure 3-49.

When the V sync signal appears, IC908 forms a divide by 2 to produce a frame rate signal at the Q output (IC908-3) which triggers an MMV (IC917) to produce an interrupt request (low) through D901 to the CPU group.



Through an interrupt routine, a new group of time code data is sent to the output port IC921, Port A (8 bits). This output data is the first eight bits of the 80 bit code, so 9 more groups must follow, and these are stored in the FIFO memory by a shift signal that moves the data inward (SI) pin 17. This shift signal comes from Port C bit 0. In order to tell when the Data is available at the output, the Master Reset (MR), which does not reset the data but only the control registers, is reset at the beginning of the cycle. Then the 10 groups are shifted in, and then the shift input (SI) is toggled until data appears at the output ready (OR) pin 12. This completes the MPU dump of time code data, and the interrupt is complete.

Now the data is held in ten 8 bit groups.

These eight bit groups (parallel, or all 8 together) must be converted to serial data (eight bits one after another in time) and then strung together like beads. This string of data must then be made into a bi-phase time code signal.

Each time the clock of the shift register occurs, each bit shifts up to the next level.

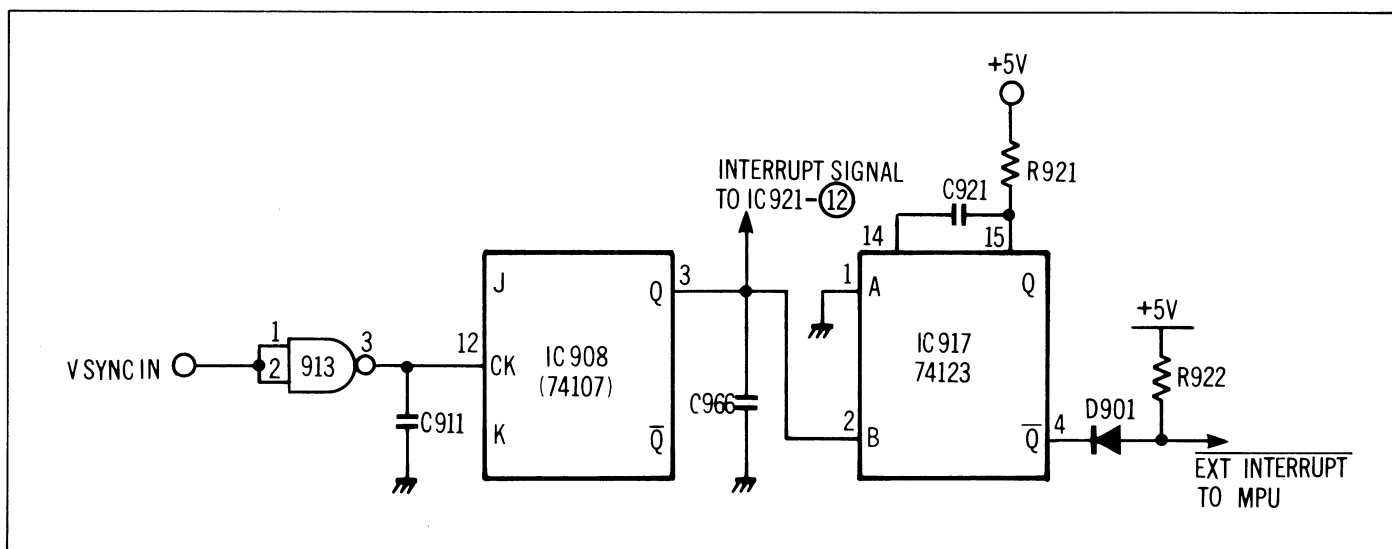


Figure 3-50

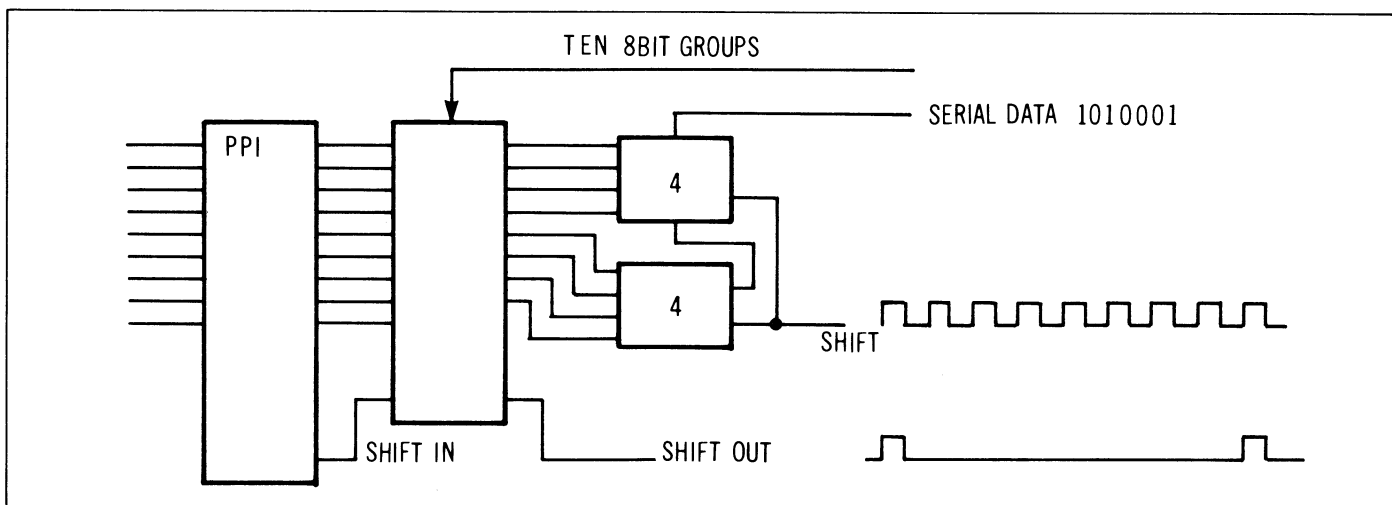


Figure 3-51

The top flip flop holds the current bit, when the clock occurs, the top flip flop changes to the next bit, and then the next, leaving out the data in series. When the eight bits have all been clocked up to the top most D Q output, the FIFO will be clocked to present 8 more bits, the mode control will shift on the shift register, and the 8 bits will be parallel stored in the eight ff of the shift register. Then the mode control will return low, and serial count out will begin again. To do this two clocks are required in an 8 to 1 ratio and the mode select must be considered.

Data Clock

As described previously, divided subcarrier (3.58 MHz) produced three clock signals (CL ϕ , CL1 and CL2) which are used to form the output biphase signal.

Since the output is one bit of data at a time, They must be shifted so a new bit is ready to be output. This is done by CL1, and because of the output logic CL1 is used for actual output. This means the bit only shifts during the inactive period of the output.

At the end of eight shift commands, the shift register is empty, and a new word must be input from the FIFO. To get a new word, the FIFO must shift one step at the output (SO) and then the shift register must parallel store (M high and clock CL).

After this, the cycle of shift and generate output resumes. In order for the biphase output to appear continuous, all this is done by a fast clock CLC, which is made from sub-carrier (3.58) divided by eight (IC937-8).

At the eighth CL1 pulse, the output of IC905 (6) goes low and triggers the SO Shift Out of IC921, the FIFO, to move new data to the output. This eighth CL1 through IC905 (6) goes to IC902 (6) to reset IC908 (5) to inhibit further CL1 pulses. This makes the Q output high (IC908 (6)) which enables IC905 (8), and a CLC (1/8 S.C.) pulse sets IC909 (3) Q high. This is the mode (M) control for IC917, 918, the shift register.

The M high also enables IC914 (at (12)) so the next CLC pulse goes to IC902 (10) and becomes the clock (CL) pulse to parallel store the data. This same pulse (IC914 (11)) resets IC909; which sets IC908 through IC902 (6).

This enables IC902 to pass CL1 pulses again. The process will repeat itself in 8 CL1 pulses. Note that this entire process takes about one hundredth of pulse CL1, and so is invisible to the time code output.

The data is shifted out and sent to IC911, where it is clocked into the flip flop IC907, which generates half or full width pulses of opposite phase to the previous pulse. See Figure 3-52.

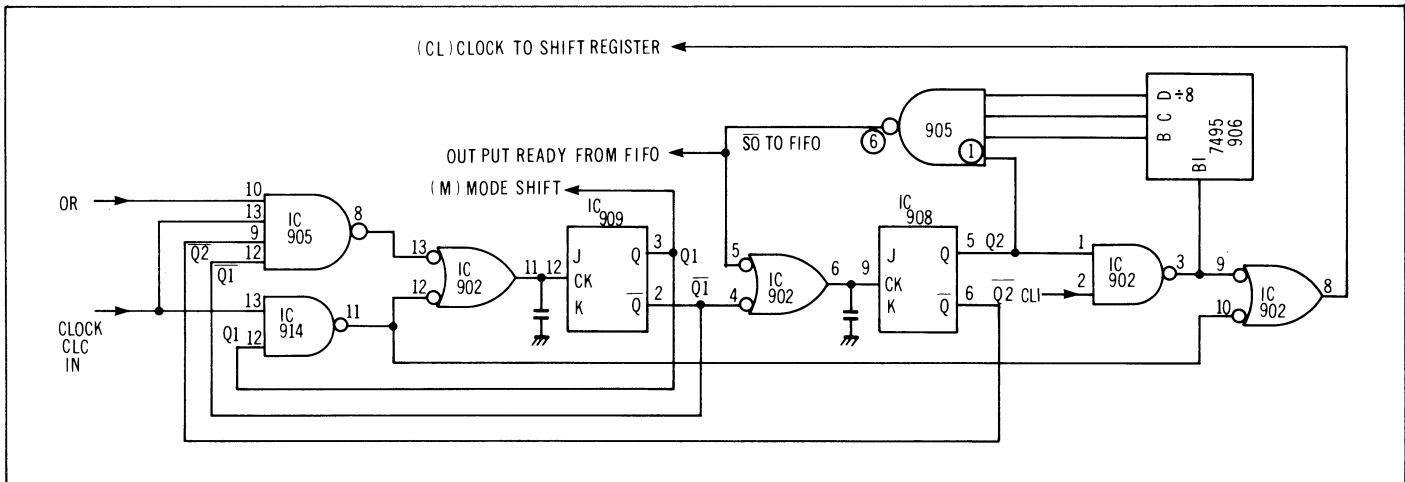


Figure 3-52

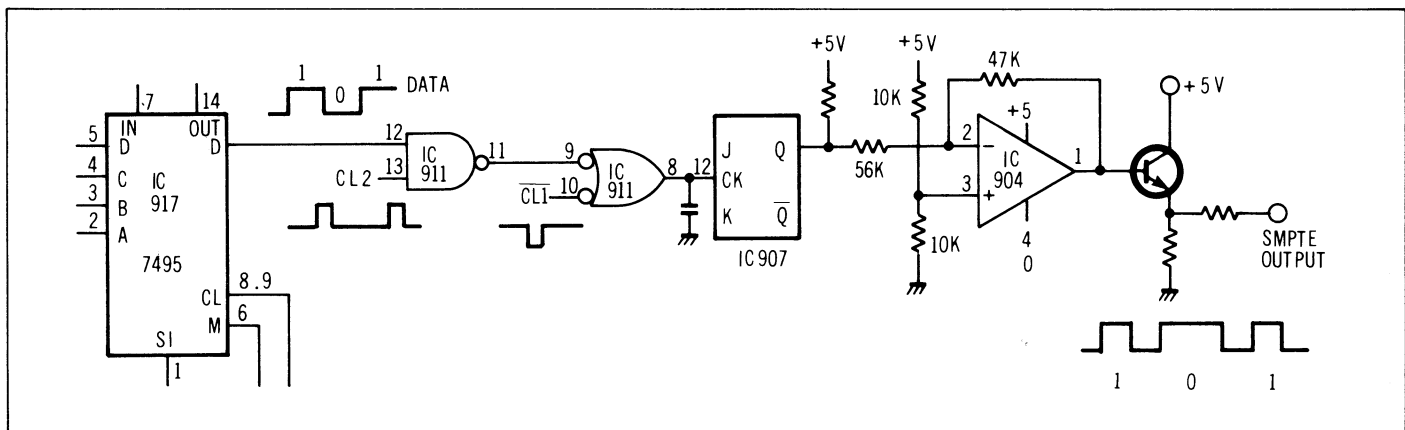


Figure 3-53

TIME CODE READER

The Time Code Reader Circuit consists of two identical circuits, one for the Source VTR and one for the Editor VTR. The Editor Time Code Reader circuit will be used for reference drawings.

The Bi-Phase SMPTE signal at connector P96-(3) comes from tape playback, and is supplied to the Shmitt trigger circuit, IC952, to shape the waveform.

Because the output of IC952 goes to both the positive trigger (B) and the negative trigger (A) of two MMVs in IC 956, the signal is differentiated at both the rising and falling edges. (See Figure 3-54). Both MMV output pulses are nor gated by IC950 to produce a combined pulse train. See the timing chart Figure 3-47-(1) (2).

This combined pulse forms a type of clock, and will be used to detect if the bi phase (SMPTE) input is 1 or 0.

When a "0" is detected after a "1" or "0", the process starts to function. Point T in Figure 3-47 indicates the starting point.

The key to time code detection is a self-setting threshold level detector and comparator. A variable charge rate sawtooth generator makes a sawtooth, which is peak level sampled to set a comparator reference. If a "0" in time code appears the sawtooth charges to a higher level that if a "1", because of the longer time between pulses.

If the sawtooth is reset every time an input transition is detected (IC930 (11)), then it changes for a time equal to the space between pulses. If when a short pulse is detected, a 1, the value of the sawtooth just before reset is held in a capacitor (sample and hold), and that value is used for comparison. A simple opamp comparator can tell if the sawtooth goes above the reference. Any time the sawtooth exceeds the reference, the data is a "0", and the sample and hold is not activated, since this would upset the 1 level threshold.

This system is required because the tape can go such different speeds that no one R/C time constant would be right, nor would any one threshold voltage.

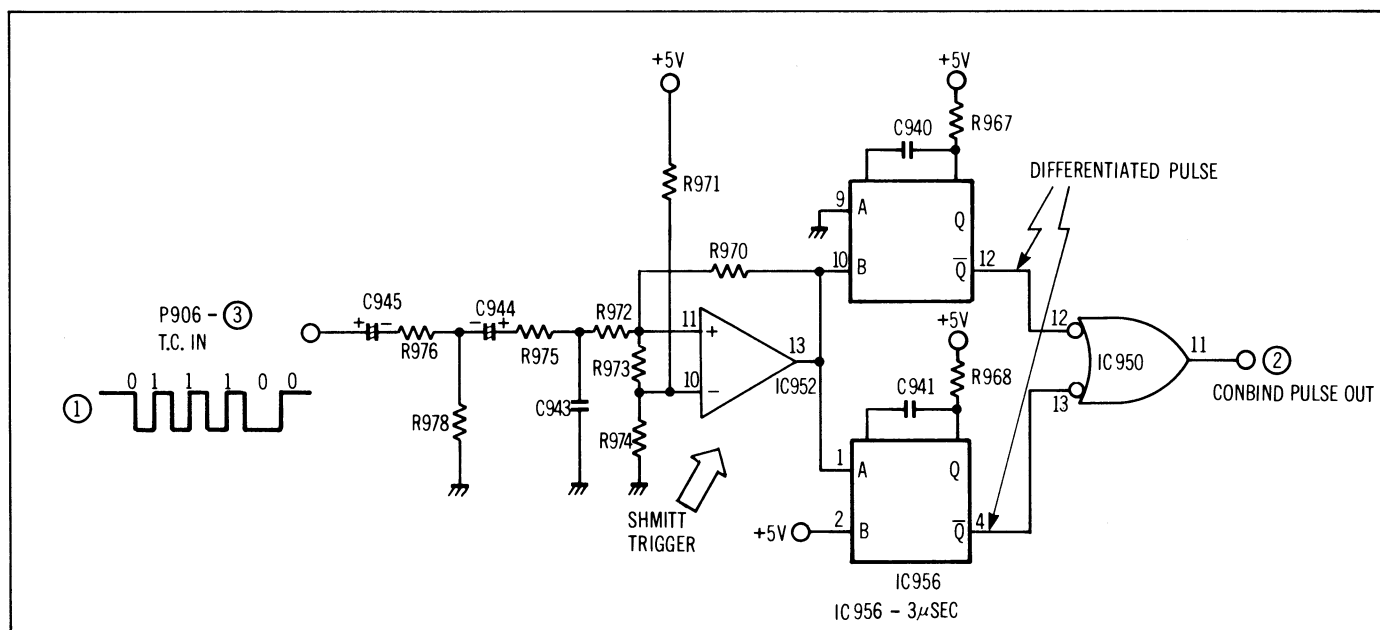


Figure 3-54

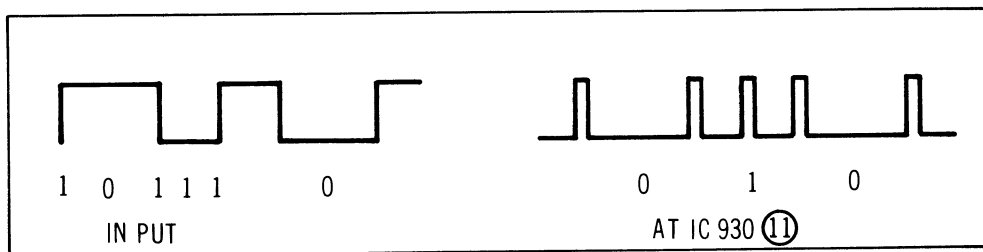


Figure 3-55

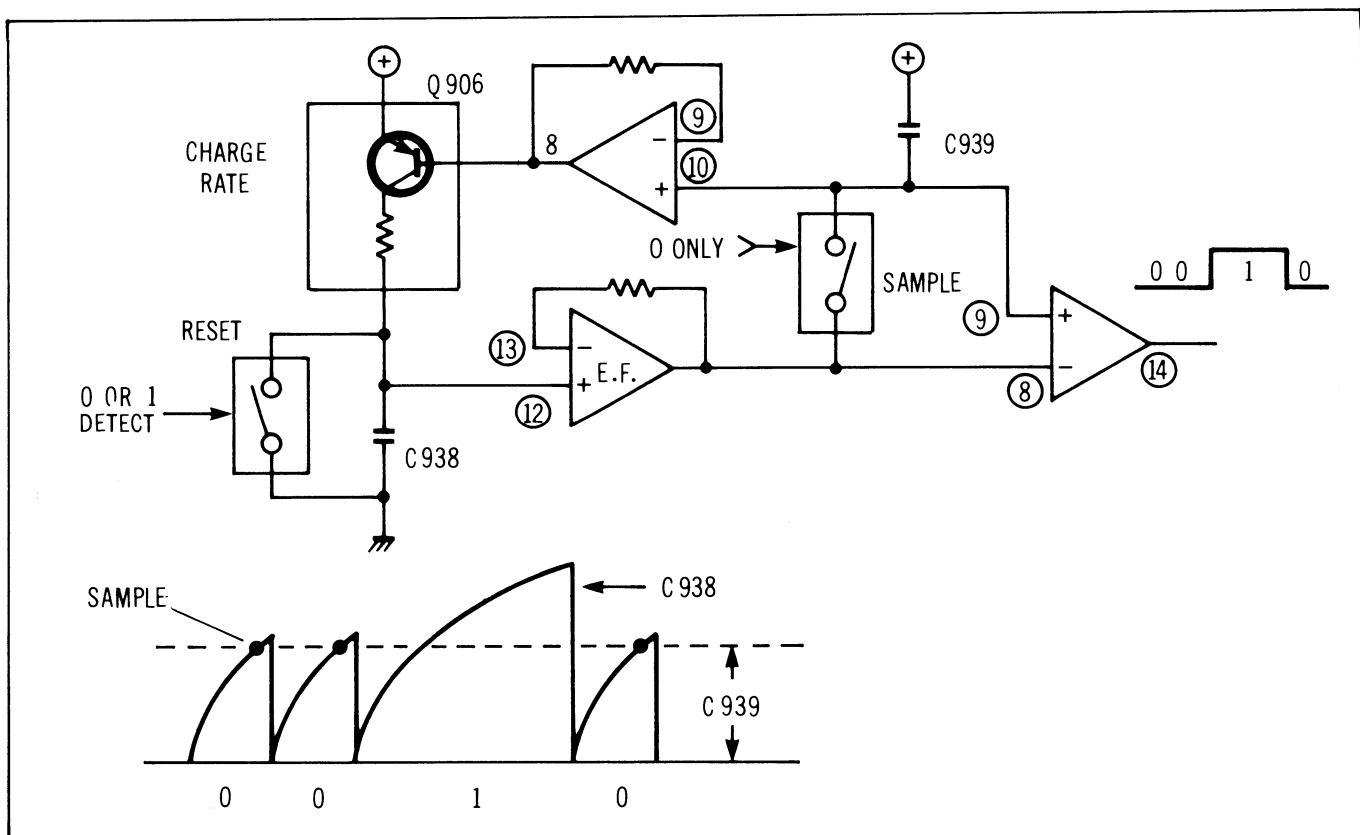


Figure 3-56

Since each "1" in the time code signal develops two pulses at IC950 (11), one of these must be removed. A "0" however, has only one pulse. Therefore, when the output of IC952 (14) the comparator is low ("0"), the input pulse is used to make a 0 shift pulse.

The low data at IC952 (14) is inverted by IC948-12, 13, and then that high allows the pulse at IC950 (11) to exit IC950 (8) be inverted by IC950 (3) and shift the shift register (CL).

At this time, the serial input (SI) is Low, storing a “0”.

At the same time, this output from IC950 (8) triggers IC954 (MMV) to discharge the sawtooth through IC955.

If the data is a one, then the output of IC952 (14) is high, and when it is high, IC951 (FF) will be toggled. (when it is Low, IC951 Q will stay Low.) This is the 1 hold signal or 1 H, and it will keep the middle pulse made at the input from reaching the shift register. Since Q is low on the first pulse, IC950(6) cannot generate a pulse for IC950 (3), the shift pulse. But on the second input pulse (IC950 (11)), IC951 (3) is high.

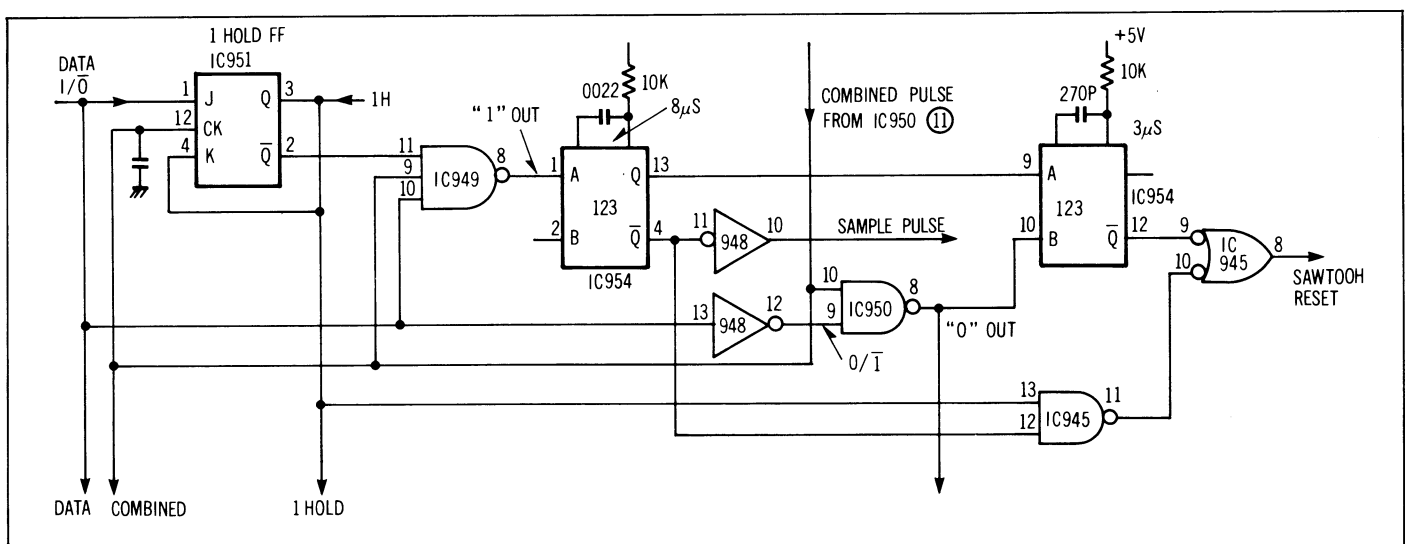


Figure 3-57

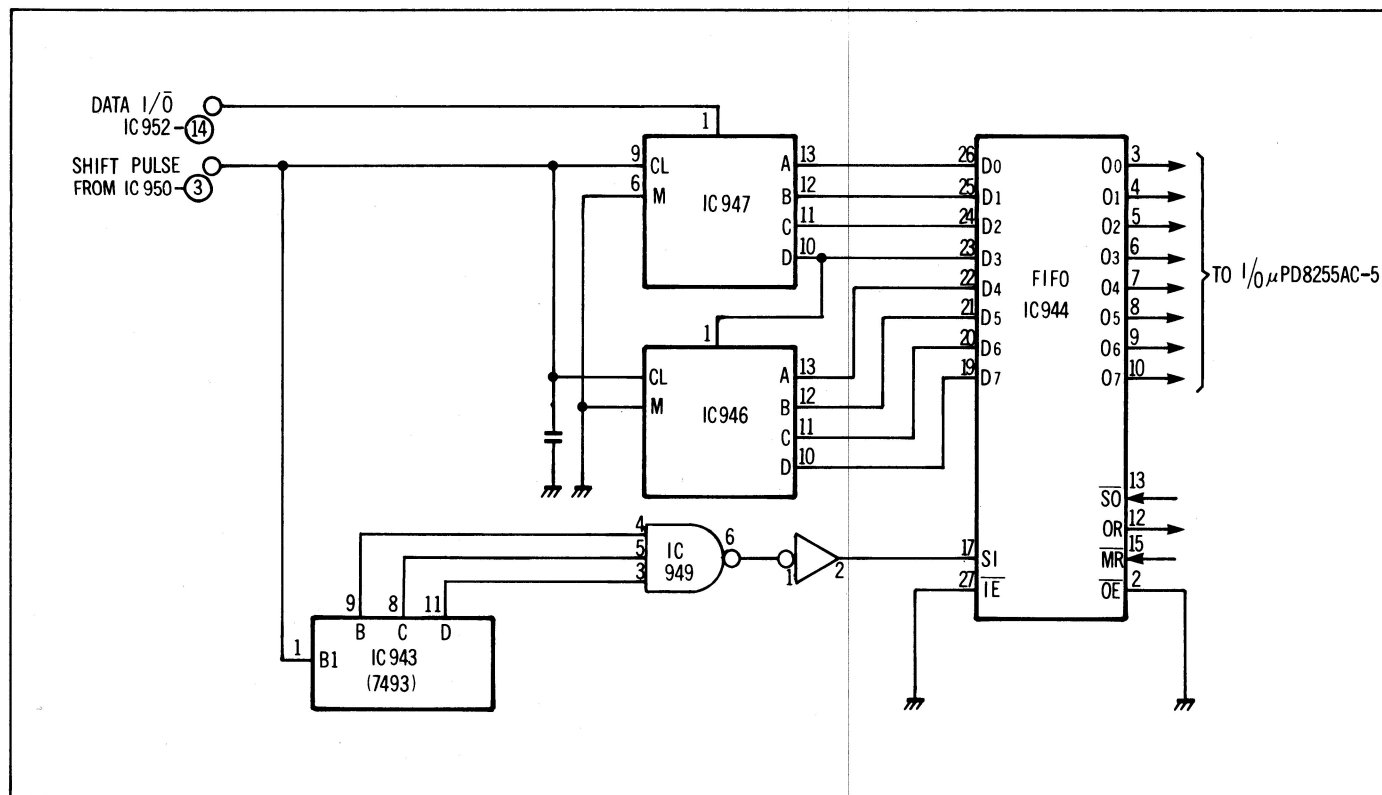


Figure 3-58

So is IC952 (14), the comparator, which goes to the shift Input (SI). This time, a pulse from the input goes through IC950 (6) to IC950 (3) to shift the register one step. In addition, the 1 detected signal fires IC954 (MMV) to sample the sawtooth peak and store it in C939, just prior to triggering IC954 (9) to discharge the sawtooth and start again.

When eight shifts have taken place, the shift register is full, and the eighth pulse causes the FIFO to shift all eight bits inward, leaving the shift register available for eight more several bits.

When the FIFO is full, it signals the CPU by means of the OR (output ready) and then the CPU can shift out through the SO input the ten eight bit words which make up a complete time code signal. Then the master reset will clear the control registers, so the OR flag does not appear for another ten steps of the FIFO.

The data is input to the CPU via IC922, Port B.

The source reader functions in the same fashion but uses Port A.

Additional Memory

Because the AU-A70 Edit Controller Can store and perform twenty edit sequences, provision must be made to store that information.

On the I/O circuit board, VEP2611, are providing for 6 memory RAM IC positions. Only two of these are used. This RAM memory is implimented with a 2114 memory, 4096 bits organized as 1K (1024) four bit words. This means that, as in the case of IC348/349 on the MPU board, the 4 LSB are stored in IC819, and the 4 MSB in IC817. Both chips are enabled (CS) at the same time by RAM4, which was decoded on the MPU board.

The 2114 is a static (flip-flop) type memory.

Although it has a long access time and high power dissipation (compared to a dynamic RAM), it requires no clocks or refreshing (See Figure 3-58).

The write enable (WE) controls the read write mode change.

Additional I/O Provisions

This model can control three VTRs in an editing system, as well as integrate line video (LINE), into multiple pre programmed edits.

Therefore extended I/O capability is required beyond the ports described above (which are located in the MPU board, VEP2609), and three additional 8255 PPI circuits are located on the I/O Circuit, VEP2611. These function in the same fashion as those described previously, but are assigned different functions.

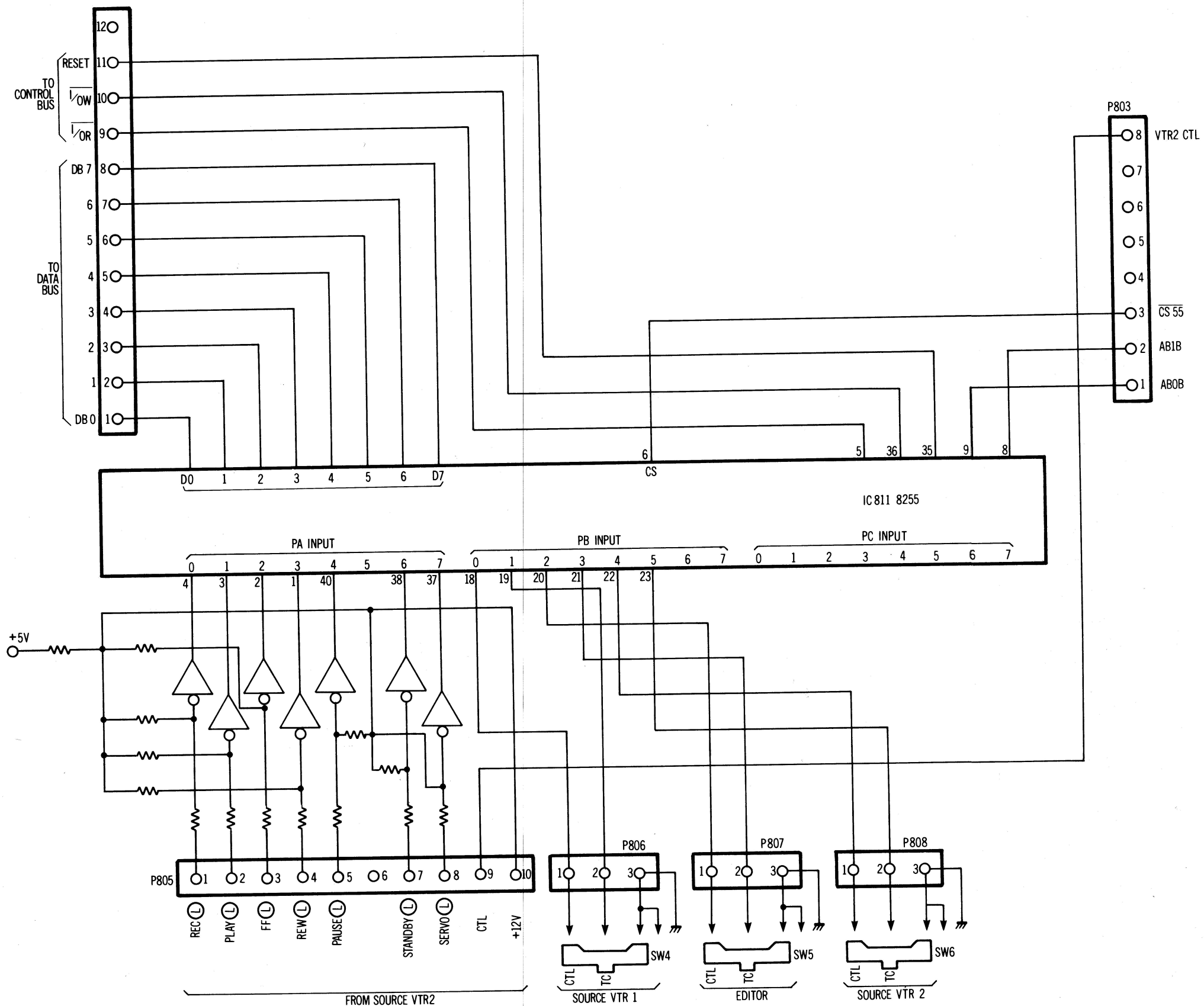


Figure 3-59

VTR 2 Input

Inputs from the VTR Lamp outputs are detected for VTR 2 just as for VTR 1 (source) and the Editor. The lamp signals from the VTR 2 pin remote control come to IC807, 808, input level buffers, with the pull up resistors going to +5 with no VTR and +12 from VTR 2 when connected. The buffered lamp drive signals go to port A of IC811 (another 8255 PPI).

(See Figure 3-59).

In addition, IC811 Port B provides input for the three Time Code/Control Track (CTL) reference switches. The Edit Controller can use either CTL pulses as the tape position reference or SMPTE time code information (See Time Code section).

However, the CPU must know which is to be used, and these switch inputs provide that data through 6 bits of Port B.

VTR 2 Output

The Edit Controller must direct VTR 2, the second source VTR, in the same manner as VTR 1. Therefore, Ports A, B and C of IC809 are dedicated to VTR 2 outputs. The output functions exactly like IC305 and 319 on the MPU board, with IC801, 2, 3, 4 open collector buffers for level transition, since the control inputs of the VTR go low to activate a mode.

(See Figure 3-60).

As was true for the Source and Editor described in the main I/O section above, a three position switch tells the CPU if VTR 2 is an NV9600/AU700, or an NV9500, or a VHS unit. The CPU then limits the output commands to those appropriate to each model. This switch input comes into Port B of IC810, bits 0, 1, and 2 (See Figure 3-61).

AU-J10 Multiple Source Adapter Output

The AU-J10 is a companion unit to the AU-A70 Edit Controller, and provides for signal switching between sources. It receives its commands from the AU-A70, and the CPU outputs them from Port A of IC810, Bits 0, 1, 2, 3. IC806 performs as a level shift open collector driver, as did 801-804 (See Figure 3-61). One of these outputs. Trigger out, appears at the AU-J10. It is identical to the Pre roll play command for either source VTR, but is used with the Line input. This allows a film projector or audio tape to be synchronized for editing purposes. The Trigger out occurs 4.5 seconds prior to the Edit point.

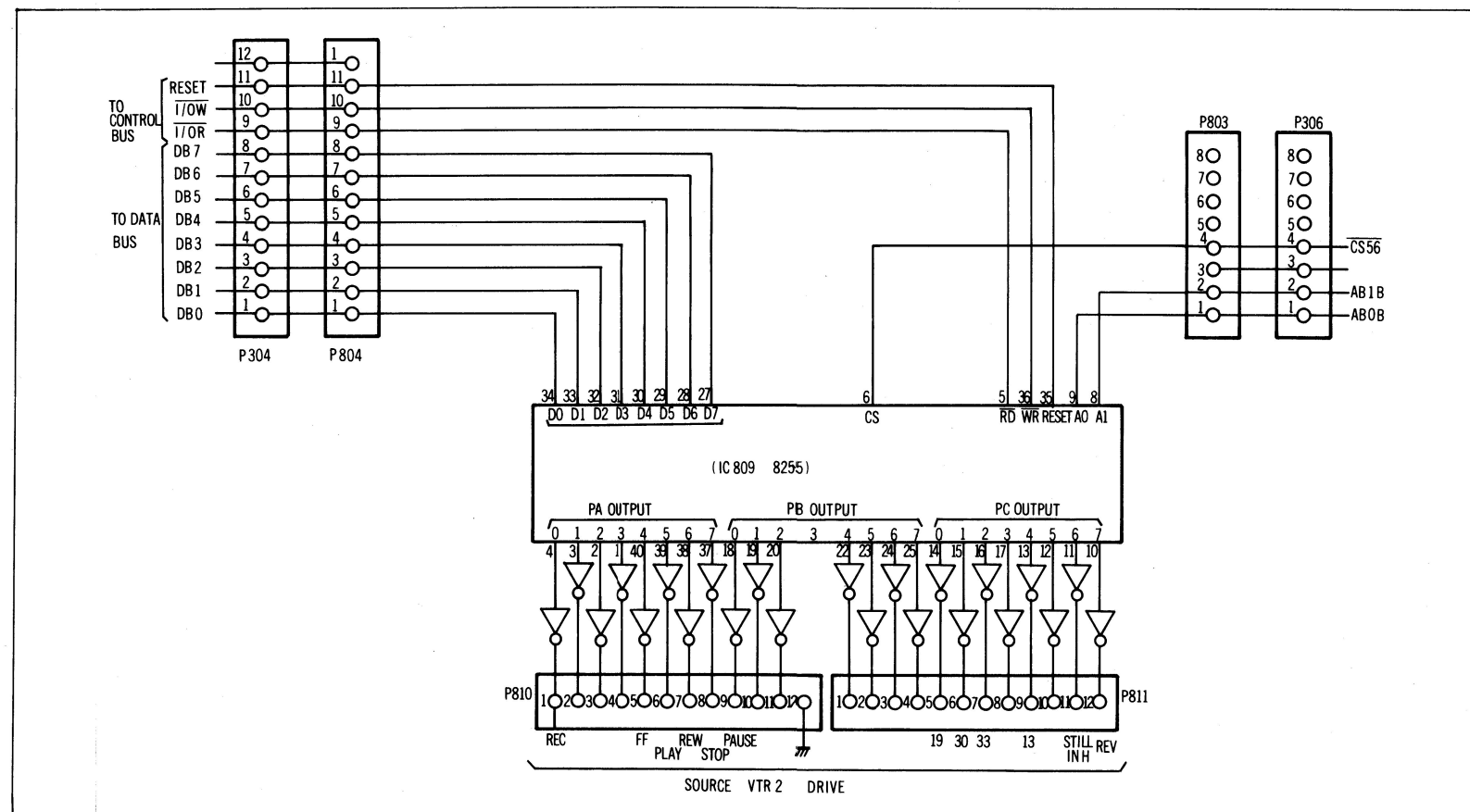


Figure 3-60

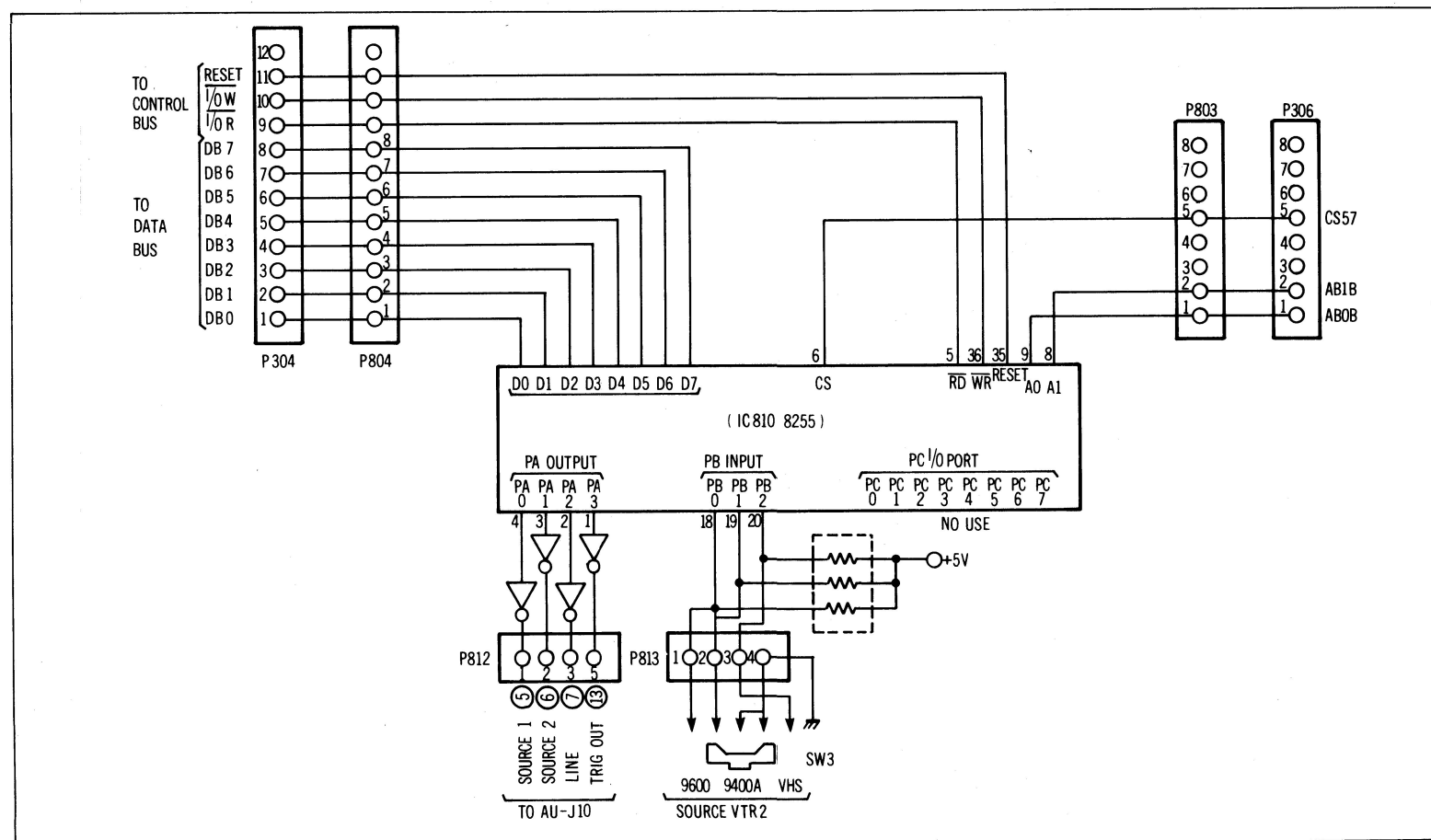


Figure 3-61

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